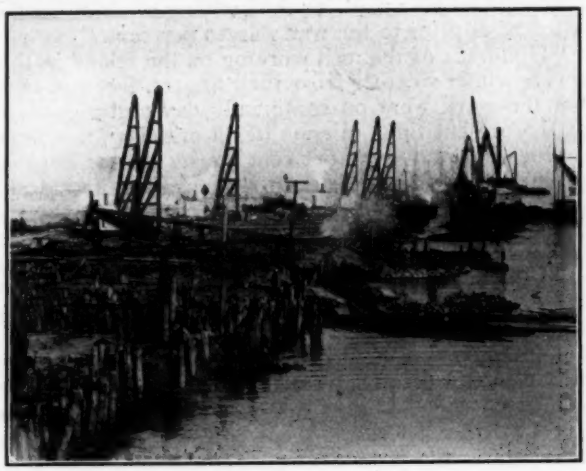
Electrical Review

WITH WHICH IS CONSOLIDATED WESTERN ELECTRICIAN AND ELECTROCRAFT.

Vol. 73.—No. 5. CHICAGO, SATURDAY, AUGUST 3, 1918. Page 155.



General Views at Hog Island, Showing Small Portions of Shipways.

A Record of Achievement at Hog Island

Some Interesting Statistics on the Work in Progress and the Results Already Secured at the World's Largest Shipbuilding Plant

By W. H. BLOOD, Jr.

Assistant to President, American International Corporation.

In view of the criticism and publicity given the work at the Hog Island shipyard, it should be of interest to every American citizen to read the statement of W. H. Blood, which was presented before the recent convention of the National Electric Light Association. Incidentally, Mr. Blood is a past-president of this association and a prominent figure in the electrical industry.

Additional data on the Hog Island project were published in the ELECTRICAL REVIEW *for February 16, 1918.*

SOON after the war was declared with Germany, the United States Shipping Board asked the American International Corporation what it could do to help in the construction of ships. The American International replied that they could build a large shipyard in short order and turn out very large quantities of standardized or fabricated ships. The American International was asked to do this for three reasons. First, this company had unlimited capital of its own. Second, it could command the services of Stone & Webster, the largest engineering and construction organization in the world, and third, it could supply the shipbuilding talent of the New York Shipbuilding Corporation of Camden, N. J., one of the best developed shipbuilding plants in the country. On September 13, as the result of the various negotiations, a contract was awarded to the International Corporation to build this shipyard and to construct 50 7500-ton ships. On October 23 it gave them an additional order for the building of 70 8000-ton ships.

The American International Corporation began immediately to construct the yard and the work was carried on with diligence all through the most severe winter on record. The prime factor in the contract was speed and everything was done by the Corporation to build the yard and to get the ships out in the quickest possible time. Work began immediately on signing the contract and on February 12, when the yard was 50 per cent completed, the building of ships began. As high as 26,000 men were employed on this work. The Shipbuilding Corporation invested $1,700,000 of its own money in the purchase of the land, which at that time the Government had no means of acquiring. The shipyard itself will contain 50 shipways and seven outfitting piers, capable of handling 28 ships at one time. It is as large as six of the largest shipyards in the country at the outbreak of the war and contains a capacity equal to one-quarter of the present total capacity of all the shipyards in Great Britain. This number being reported by Sir Eric Geddes, First Lord of Admiralty, as 209. In building this mammoth shipyard the total expenditure will run upwards of $50,000,000 and for doing this work no fee or commission of any kind is paid to the American International Corporation or any of its subsidiary organizations. The Government reimburses the Corporation for all its expenditures for material and for labor but does not pay the Corporation any profit whatsoever.

The contract for the shipyard and the ships aggre-

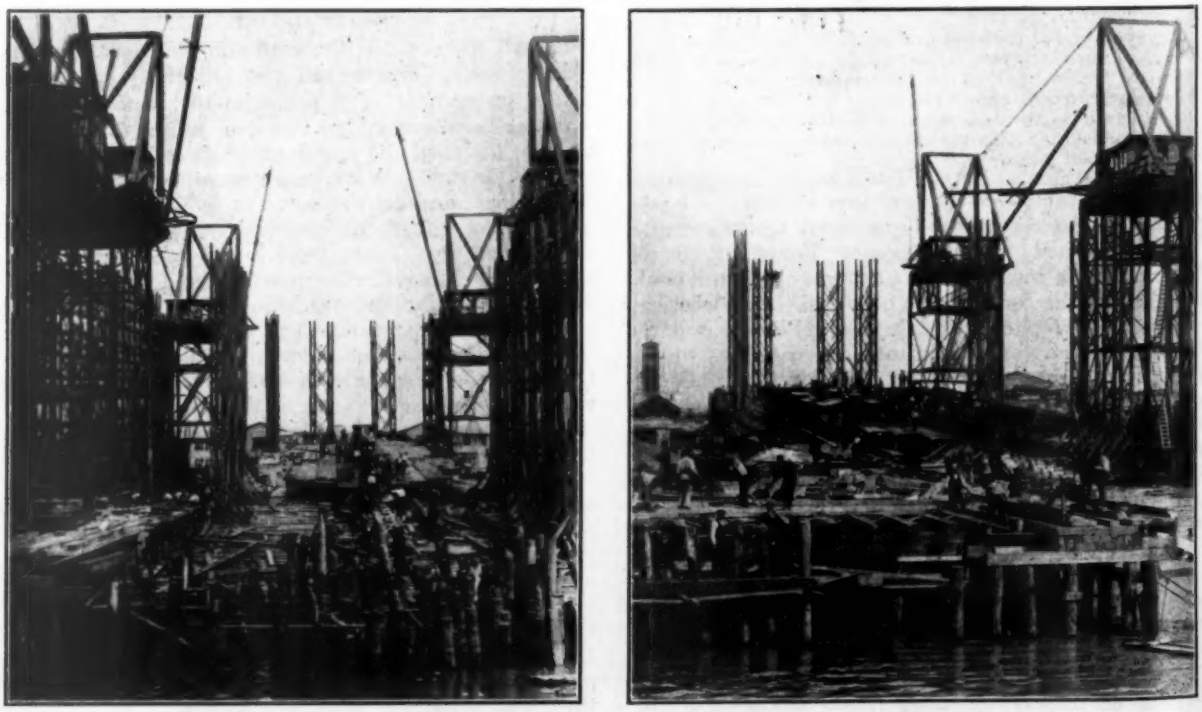
gates about $200,000,000, the largest single contract ever awarded in the history of the world. The 7500-ton ships are estimated to cost $1,050,000 each. The 8000-ton ships, which are combined cargo and troop ships, are estimated to cost $1,650,000 each. For building these ships the American International Shipbuilding Corporation is paid a fixed fee per ship, not a percentage contingent on the cost. The fee, however, if it were figured on a percentage basis, would be approximately four per cent, which is the lowest fee the Government had ever paid for the building of ships, as the usual basis prior to the war was 10 per cent.

Hundreds of the men working on the Island in this severe winter weather froze their fingers, feet and ears, but the work went on continually day and night and at the present time, in spite of all criticism, the work on the yard is over 80 per cent done. No evidence of profiteering or fraud or extravagance of any kind has been discovered by the Commerce Committee or by the Federal authorities who have investigated this gigantic undertaking. On the other hand, everyone who has seen the work marvels at the fact that this desert has been changed in a little over six months into a going shipyard. As evidence that this work has been prosecuted honestly and efficiently, the Shipping Board has just signed a new contract for the construction of 60 additional ships, so that this yard is at work turning out 180 ships. Even if there had been extravagance or waste in the present exigency, it would have been justified, for the commercial value alone of these 180 ships is $14,000,000 per month; that is, they could be earning at rates fixed by the Shipping Board Chartering Committee about $460,000 a day, or $14,000,000 a month. This does not take into consideration their value as a war proposition which is beyond computation.

In building this yard there have been used about 145,000 piles running from 60 to 70 ft. in length. Over 105,000,000 ft. of lumber has been used for construction purposes. These two items together would make a plank walk a foot wide long enough to reach entirely around the world. There have been received on the tracks in the yard as high as 250 cars of material a day, although there are facilities for handling more than double this number. To accommodate the material as it arrives and to properly distribute it to the ways and to the storehouses there is being constructed 83 miles of track within the yard. When the buildings which are now nearing completion are finished, they will cover a total area of approximately 25 acres.

The Hog Island shipyard covers approximately 900 acres, which, if superimposed on the City of New York, would cover all of the downtown district from river to river, up as far as Eighth Street. Hog Island is a complete city, having every utility known to the modern city with the exception of a saloon and a cemetery. It has 85,000 ft. of high-pressure water piping, 120,000 ft. of domestic water piping, a complete sewerage system capable of taking care of a population of 30,000. It has 260 fire departments with 100 men on duty 24 hours a day. Over 20,000 shovels and 10,000 picks have been used in constructing the yard. For handling the material in the yard about 165 automobile trucks have been used as well as 70 locomotive cranes and 450 freight cars. The electric wires for supplying the various electric motors and electric lights throughout the yard total 3,000,000 ft. or long enough if stretched in a straight line to run from Portland, Me., to Richmond, Va. Forty thousand electric lamps are used to illuminate the yard and the ships and 650 electric motors will furnish power.

The weekly payroll has been as high as $800,000 and it is now running about $600,000 per week. Union wages are paid throughout. Barracks for accommodating 6000 men have been erected on the Island and about 30,000 meals are served each day at 30 cents, which simply covers actual cost of food and service. The Island contains a first-aid hospital with motor-driven ambulances, eight doctors and a staff of trained nurses. There is also provided a dentist, who is on



Two Shipways at Hog Island Yard Showing Keels Being Laid.

the job 24 hours a day. There is a bank on the Island, which handles from two to three tons of silver each week. The Hog Island men have a weekly paper published in the interest of men and it is distributed free every Saturday, the present circulation being about 30,000 copies. A complete Y. M. C. A. building with an auditorium seating 2000, an up-to-date gymnasium, etc., is also maintained. The company operates a school for training men for riveting and other metal trades. Already about 1000 riveters have gone through the school and are doing excellent work on the ships. To guard the property from enemy attack, there are being used 600 guards, who have seen service elsewhere, they having been sworn in as deputy sheriffs, and the entire organization is patterned after the Pennsylvania State Constabulary.

The company started the erection of ships on February 12, just five months, lacking one day, after the contract was awarded and every few days a new keel is laid down. Each ship requires approximately 20,000 separate items. Steel, of course, is the most important. The rolling mills are turning this out in satisfactory amounts, but at the present time there is a delay in the fabricating shops. About 70 shops situated all over the country have been utilized to supply material for the ships. When the yard is under full swing, 50,000 tons of steel will be utilized each month and in building ships now under contract there will be required 90,000,000 rivets and in addition to this there will be required 570 boilers and over 700,000 horsepower in steam turbines. Before the summer is over this yard will be turning out ships at the rate of one every other day. These will be ships of either 7500-ton or 8000-ton capacity and the present contracts call for a merchant fleet of nearly a million and a half tons capacity. This is nearly five times as much as all the shipyards in the United States turned out annually before we entered the war. The Hog Island yard will very properly earn the title, "The greatest shipyard in the world."

ALUMINUM PRODUCTION OF THE UNITED STATES.

Now Largest Producer in World, Turning Out About Half of Entire Product.

The recent action of the President in fixing the price of aluminum calls attention to the rapid growth of this industry in the United States, which has now become the leading world producer of aluminum. A compilation by the National City Bank of New York shows that the production of aluminum in the United States has grown from 60,000 pounds in 1890, to 7,000,000 in 1900, 48,000,000 in 1910, 100,000,000 in 1915, 140,000,000 in 1916, and approximately 180,000,000 in 1917, these figures being in round terms. The value of the product, which amounted to a couple of million dollars in 1900, was 16 millions in 1915, and approximately 46 millions in 1917.

This rapid increase in production in this line places the United States far in the lead among the aluminum-producing countries of the world. In fact, about one-half of the world's output of aluminum is now produced in the United States, for while authorities differ somewhat as to the production by certain of the respective countries, they agree that the United States now produce about one-half of the world's output, which is variously estimated at from 135,000 to 150,000 tons, or slightly more than the world's production of tin, for which aluminum is now becoming a substitute in certain lines.

This fact that aluminum is proving an acceptable substitute for tin in certain industries, and that its cost is no greater than that of tin, is especially interesting and important to the United States because of the fact that while it produces no tin, and sends large sums of money abroad for that article, it is now the world's largest producer of aluminum and able to increase indefinitely its output. While most of the aluminum production of the United States at present is for use in aeroplanes, automobiles, helmets and cartridges, the possibility that it may be found an acceptable substitute for tin for certain general industries, and thus reduce the dependence upon foreign countries, adds importance to the rapid development of the aluminum industry in the United States, a non-producer of tin. Nearly $500,000,000 has been sent out of the United States in the last dozen years in the purchase of tin, most of it brought from the other side of the globe.

The aluminum production of the world in 1916 is set down at approximately 140,000 tons, of which approximately 62,000 was the product of the United States, 20,000 produced in France, 16,000 in Norway, and 8000 in Canada. Figures differ radically as to Great Britain, ranging from 4000 to 12,000 tons production. In Switzerland the normal product is about 20,000 tons, but has been materially reduced by inability to obtain from France the bauxite from which aluminum is produced.

Bauxite, the mineral from which most of the world's aluminum is produced, is found in many parts of the United States, though the bulk of that now used in the industry is the product of the state of Kansas, and is turned into the finished aluminum at several great establishments in various parts of the country, the most important being at Niagara Falls, water power being deemed an important factor in its successful production. Other works recently established are in the states of New York, Pennsylvania, New Jersey, Maryland, Tennessee and North Carolina.

ENGINEERING DIVISION IN U. S. EMPLOYMENT SERVICE.

The action of the Government in establishing a Division of Engineering, as a part of the United States Employment Service, is gratifying to technical men, as it is regarded as a fine recognition of their capacity and training for special duties. Engineers are asked to obtain registration blanks from A. H. Krom, director of this division, in Chicago, and fill out and return same to him, with the object that their services may be utilized for the benefit of the nation and for the welfare of the engineers themselves.

The keynote of the present war is organization. Efficiency in every department of military and governmental activity has been obtained by perfected organization, worked out in every detail. The Government is now giving the individual technical man an opportunity to organize his specialized energies and training, by means of registering with the Division of Engineering.

The alert, patriotic technical man will at once become conscious of the value of such registration. He will register immediately and will urge all other technical men to do the same, in order that the whole body of information relating to the technical men of the nation may be placed at the disposal of the Government.

Interesting Small-Capacity Low-Head Hydroelectric Development

Geddes Plant of the Detroit Edison, Fourth Power Plant on Banks of Huron River, Typifies Utilization of Low-Head Water Power

THE Geddes hydroelectric plant placed in service during the early summer of this year by the Detroit Edison Company has a number of interesting facts connected with it. The plant is essentially a small-capacity low-head plant, for the initial and ultimate capacity is only 1000 kilowatts, and the working head utilized averages about 15 ft.

The location of this hydroelectric development on the Huron River, 34 miles from Detroit, has been used for harnessing the river's water power since 1828 when a dam was first thrown across the river by John Geddes, who used the power for driving paper mills, saw mills, etc. This dam was washed out in 1878 and rebuilt the following year and used till 1900. In 1900 the site was purchased by the Washtenaw Light & Power Company, who erected a generating station and furnished light and power to Ann Arbor and Yysilanti. This station remained till 1916, when the site was purchased by the Detroit Edison Company. Work on the present plant commenced in July, 1916, and reached completion in the early part of May of this year.

The Geddes hydroelectric station makes the fourth hydroelectric plant operated by the Detroit Edison Company and in parallel with its other stations. It is interesting to point out that all these four plants are built on the Huron River, hence all utilize the same water, which is true conservation of water-power. Moreover, all these plants are within a few miles of each other and all tie in to a transmission which connects up with Detroit.

Hydroelectric Plants Operated on Huron River by Detroit Edison Company.

Name of plant.	Capacity-No. units.	Working head.	Remarks.
Barton	1500 kw. 1-1000		Two and one-half miles
	1- 500	22 ft.	west of Ann Arbor.
Argo	1100 kw. 1- 650		In Ann Arbor.
	1- 450	12 ft.	
Geddes	1000 kw. 2 -500	15 ft.	Half way between Ann Arbor and Ypsilanti and 34 miles from Detroit.
Superior	750 kw. 1- 450		One and one-half miles
	1- 300	14 ft.	west of Ypsilanti.

These four hydroelectric plants appear very small, individually and in the aggregate, when compared with either Delray or Connors Creek with their respective capacities of 96,000 and 105,000 kw. However, they serve a number of useful purposes by utilizing water otherwise unused; they permit a river to be controlled and thus made less erratic in its flow and save coal.

The hydroelectric development at Geddes is fully developed and comprises 1000 kw., developed by two 500-kw. units. An external view of the plant is shown in Fig. 1, which also illustrates the general lay-out.

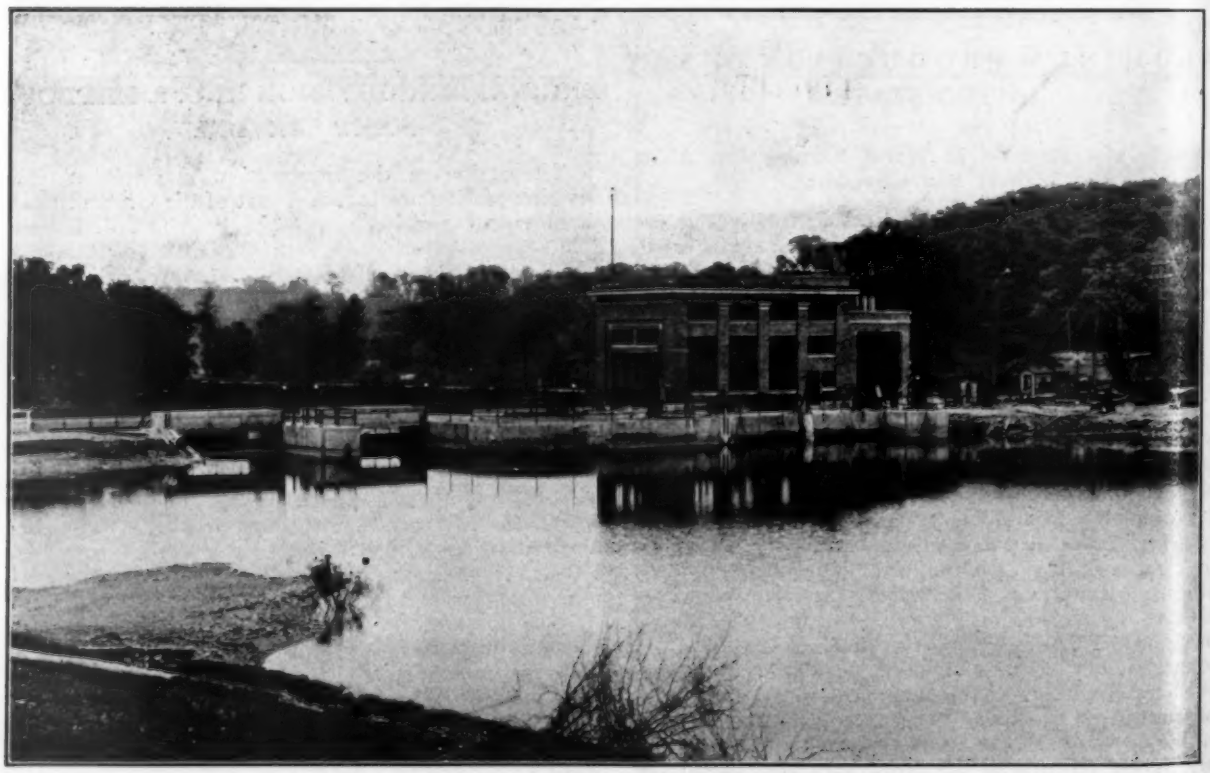


Fig. 1.—Exterior View of Geddes Hydroelectric Development, Showing General Layout of Installation.

The Huron River has been dammed by the construction of a concrete dam and spillway across the river, the foundation of the station comprising part of the dam. A considerable amount of piling was employed under the foundations of the power house and spillway, draft tubes, tail-race walls and weir footings because of the condition of the subsoil, a large amount of quicksand being encountered. The piles driven down average about 30 ft.

The power house is built of red-faced brick with white mortar and raked joints, built around a steel framework, installed upon a concrete foundation which acts also as dam for impounding the waters.

Control of Water.

In Fig. 1 is shown the spillway and retaining walls, looking downstream. The retaining walls and matt are of concrete, 8 in. in thickness, and were poured as one solid slab. The retaining walls, of the buttress type, are 25 ft. high, 15 in. wide at bottom and 12 in. wide at top, with buttresses placed every 9 ft. These buttresses are 12 in. thick and slope from top of wall back to the edge of the wall footing, which is 11 ft. from the face of the wall.

The pier installed equidistantly between the retaining walls serves the purpose of creating two spillways, of making a gate seat for the spillway gates and supporting the super-structure.

The two gates used are of the bear-trap type. They are controlled entirely by water pressure from the pond on the up-stream side of the gates and are manipulated by hand-controlled valves, accessible from the top of the pier. Each gate consists of three leaves of steel sheet, the one down-stream and one up-stream plates being fastened to a top sheet or "idler" in such a way that the three constitute what is practically a water-tight surface. The three sheets are able to move up and down vertically so that when up their cross-section has the form of the letter "A," and when down they have almost a flat surface, over which the water flows. When in the upright position the flow of water is obstructed to the extent of about 15 ft., which is the nominal working head of the plant. These gates have their idler working in steel-lined grooves in the pier and retaining walls.

Each gate is controlled by two valves, one for raising and the other for lowering the gate. When the gate is raised the interior of the "A" is full of water which has run in through one valve and thus raised the gate. To lower the gate the valve in the down-stream side of the gate is opened, with the other valve closed, the water empties out of the "A" and the gate, with the gradually decreasing pressure of water underneath it and force exerted by the water in the pond in the up-stream side of it, slowly goes down until finally all water has escaped from underneath, and the gate lies on the matt of the spillway, with water pouring over it. To raise the gate the down-stream valve is closed and the upstream valve opened. Water from the pond enters between the gate and matt, gradually lifting the gate, and in so doing stopping the flow of water.

One particularly interesting feature of this spillway and bear-trap gates is that of preventing the gates from becoming frozen up during cold weather. Down each side of the pier have been installed a steam pipe in a channel 4 in. deep by 8 in. wide, lined with 1/16 in. plate iron. This steam pipe consists of a number of nozzles through which steam escapes into the channel formed by the steel. In this way ice that may have formed along the sides of the gates when up may be readily thawed, and thus permit the gates to be lowered without protracted delay. Steam for keeping the gates from becoming ice-bound is obtained from the same source as that for heating the station.

Details of Turbines.

The turbines are Allis-Chalmers vertical units, each with a rating of 600 h. p. at 15-ft. head. The runners are supported by a single thrust bearing located above the generator, with guide bearing in the wheelpit. The thrust bearing is of special type, such that the runner or rotor floats on a film of oil. The oil is circulated by an oil pump and is further cooled by cooling coils installed around the bearing through which water is circulated. The location of the thrust bearing, immediately above the generator casing, is such that inspection may be readily made without interfering with the runner, generator or even exciter. An oil gauge glass conveniently located permits the oil level to be readily visible at all times.

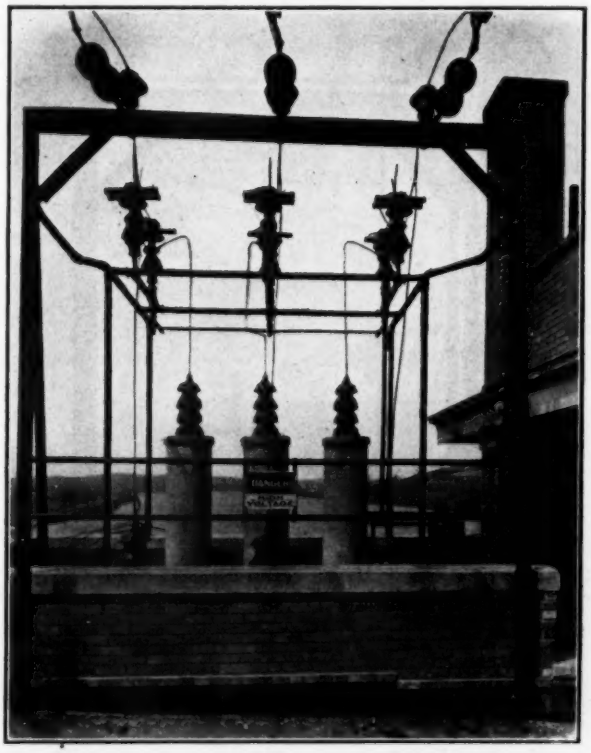


Fig. 2.—Installation of Electrolytic Lightning Arresters.

Two different designs of draft tubes are employed. The one is the design of the Allis-Chalmers Company, the other that of Gardner S. Williams, consulting engineer, Chicago. The draft tube designed by G. S. Williams is set 8 ft. deeper than that of the Allis-Chalmers Company. Both, however, have a bearing of 30 ft. of wood piling distributed as to the loads they are called upon to carry. The wheel-pits of both draft tubes measure 22 ft. across the intake and are 19 ft. in height.

A trash rack of iron grids with about 2½-in. centers is anchored across the turbine intakes to prevent fish and trash from entering the turbine casing.

The generator room, which is the super-structure of the power house, being directly above the wheelpits, measures 30 ft. in width and 50 ft. in length in the direction across the river. From the turbine room a winding iron stairway leads up to the roof and the outdoor type lightning arresters installed on it. An iron

door separates the arrester room from the station stairway. The operating room and switchboard is separated from the turbine room by a steel partition of built-up sections, the upper portion being a framework supporting glass. From this room a good view of the generator room, of the two generators, exciters and their governors is obtained.

Both generators are of the Allis-Chalmers vertical water-wheel type, rated at 500 kw., 60 cycles, three-phase, 2300 volts. The exciters are shunt-wound, 125-volt machines, with a rating of 15 kw. The turbine governors are also Allis-Chalmers and work on the enclosed oil system.

Operating Room.

Here is located the switchboard and telephone and control levers for operating the two 23,000-volt circuits. From this room entrance is had to the transformer room through a fireproof iron door. So also

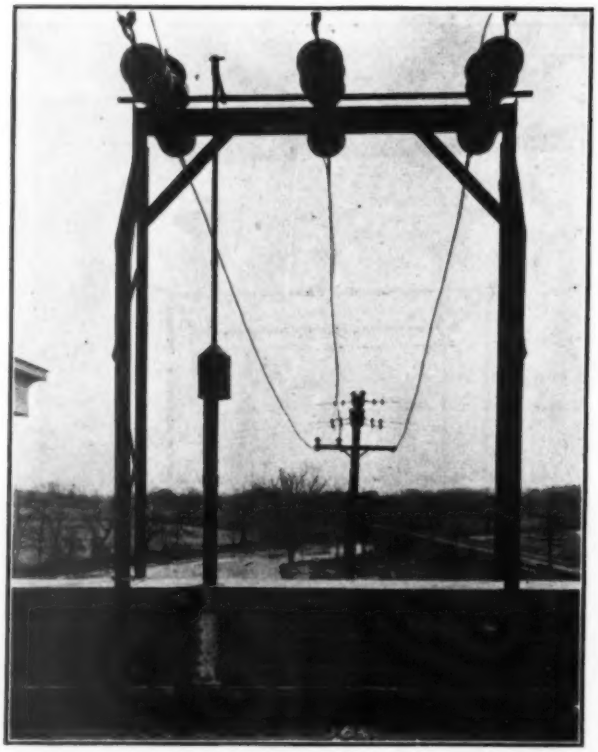


Fig. 3.—Dead-Ended Incoming 23,000-Volt Transmission Line.

is access, by stairway, had to the room beneath the operating room, which contains the exciter field rheostats, generator oil circuit-breakers, generator-bus lightning arresters, instrument transformers and generator disconnects. These are shown in Fig. 5. Here is also installed a Manistee roturbo pump, capable of delivering 350 g. p. m. at 219-ft. head, and driven by a 25-h. p. squirrel-cage induction motor running at 1755 r. p. m. This motor is automatically started. This pump is used for fire and service purposes. In a separate section of this room is also situated the heating furnace, used for keeping the building warm and the bear-trap gates from being frozen up during the winter.

A general view of the switchboard is shown in Fig. 4. There are five panels in the main switchboard, one for each generator, two for the two 2300-volt power circuits, one for the transformer for stepping up the generator voltage from 2300 to 23000 volts. There is also an auxiliary control panel installed

Fig 4.—Geddes Switchboard and Auxiliary Panel.

against the wall of the operating roon., controlling lights, pumps, etc. All panels are of brown marble.

Transformer and Vault.

The three 333-kw., single-phase transformers, connected delta-delta, step the generator voltage of 2300 volts up to 23,000 volts. The transformers feed straight through to the 23,000-volt bus on the roof. This bus is protected by electrolytic type lightning arresters and choke coils. The two out-going 23,000-volt three-phase circuits of No. 0 stranded copper dead-end at this same structure and connect up to the bus through air-brake disconnect switches. The general arrangement of the bus and arresters is shown in Fig. 3, while the methods of dead-ending the two outgoing circuits are shown in Fig. 4. Both circuits are controlled from the operating room by manually operated lever-type switches.

The transformer room or vault is an integral part of the station structure, but is isolated from the generator room by a brick wall. The transformers are able to enter and leave the vault through a metallic partition installed in the up-stream wall, thus permitting the transformers to be readily run out on a truck, along the concrete abutments to the roadway or railroad. Each transformer is mounted upon a steel truck which in turn is mounted upon runner on rails, to permit rapid movement of any unit. Moreover, any unit may be moved without interfering with either of the other units, thus should one transformer fail, the remaining two may be connected in open-delta for open-delta three-phase working.

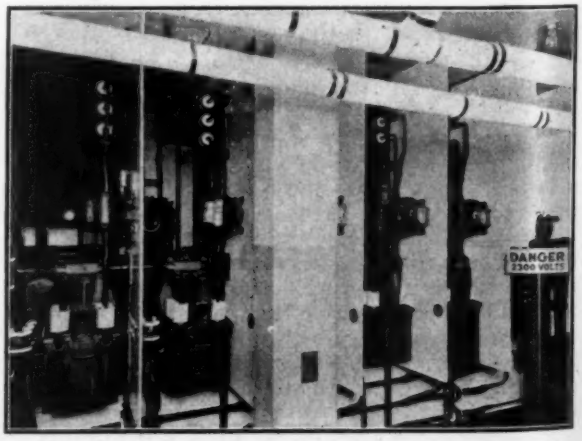


Fig. 5.—Generator Oil Circuit Breakers and Generator Bus.

Belting Problems Discussed at Chicago Meeting

Discussion of Belting and Its Use on Central-Station Service and by Industrial Plants—Salient Facts of Belting Situation

AT A CONFERENCE and "get-together" meeting which was recently held in Chicago between belting manufacturers, sales representatives and engineers, many facts of vital interest both to makers and users of belts were very clearly and forcibly brought out. The discussion was also characterized by unusual frankness.

In opening the meeting reference was made by the chairman to the fact that information of a useful nature on belting has always been scarce and very incomplete. What exists is difficult to find, and for the men that need most to know is practically inaccessible. There is a crying necessity today, with high prices, scarcity of material and general need of operating economy, for authoritative data on the choice of belting for specific purposes, on the care of belts and their maintenance. This information is particularly needed since the advent of the electric motor with its high speed, its high starting torque and ability to exert high overloads and sustained effort, when required, conditions more severe than those previously existing with merely steam engine drive.

There is also a very great mutual need today for a better understanding between the belt manufacturer, the belt distributor and the belt user. Furthermore, the manufacturers of both the machine that drives and the machine that is driven have largely ignored the manufacturer of belting, the flexible go-between upon which the operation of the complete unit depends to a very large extent.

In illustrating some of these points the chairman referred to his own experience as an engineer and executive of large companies whose specialty had been taking contracts for the complete equipment of power and industrial plants, from textiles to steel and steel products, including isolated installations such as those made for mines, pits, quarries, cement mills, saw mills, chemical and explosive plants, fertilizer and rock products plants, etc. These contracts, which frequently ran up into hundreds of thousands and even millions of dollars, usually included large orders for power transmission, conveyor and other belting, after hunting up information on the quality, choice and prices of different brands, according to the purpose for which required. If trouble developed later, the user—seldom specific in his own preference for or application of belting—always blamed the contractor or the belt itself, never his treatment of it. This was especially productive of trouble on foreign orders, such as those originating in Mexico, South America, South Africa or Australia. The problems of packing and shipment, climatic conditions at the place of service, quality of superintendence and labor, etc., all had to be carefully considered.

One purpose of the meeting was to attempt to remove some of the barriers of reticence, some of the lack of understanding and to bring about mutual interest and cognizance of conditions as they exist, and how they can be improved. The electrical operating companies and the belt manufacturers need particularly to get together, for a better common appreciation of the problems that have come about with the increasing use of central-station service. Contrary to an almost universal impression, the use of belting has increased enormously due to electrification, notwithstanding direct drive for many applications. Some belt manufacturers, even, believe that direct drive has replaced large quantities of belt. As a matter of fact, this has not occurred to any appreciable extent.

Belting Applications and Their Misapplications.

Howard Ehrlich, managing editor, Electrical Review, corroborated the chairman's statement regarding the belting situation. He emphasized the misapprehension under which belt manufacturers seem to be laboring as regards the use of belting in the central-station and allied industries. The feeling that power companies advocate indiscriminately direct-connected units in industrial plants is a fallacy. The central station primarily wants to increase its load. There is a place for the direct drive, a place for the flexible chain, gear or belt drive. Rarely are these indistinguishable. However, as regards minimum initial cost, belt drive has the advantage. A large amount of data compiled from correspondence with central stations and motor manufacturers shows that even when direct connection is used, it is actually only *possible* for about 50 per cent of motor applications to be thus met. Motor speeds for economical motor design are largely fixed, for alternating current at least, whereas the speed of the driven machine may cover a very wide range, and this fact often precludes direct connection.

Inquiry shows authoritatively, that of industrial plants using central-station service, belt drive is used in the preponderance of cases as compared with direct connection through coupling, gears, reducing gears, etc. For the remainder of industrial plants on central-station service, around 60 per cent are engineered by the central-stations' engineers as consultants. These engineers specify pulley sizes, pulley centers, spacings, and diameters, but usually leave the question as to size and type of belt in abeyance, to be later handled by a jobber or belt salesman. The central stations represent an enormous purchasing power, acting for their clients directly or indirectly. Yet ordinarily the belt manufacturers ignore this trade so far as going after it is concerned. It would come to them collectively in any case, of course, but what is worth having is worth going after. Ignoring the central-station engineers, instead of cultivating them, reacts all along the line to the detriment of all. The managers, electricians and engineers of industrial plants on central-station service also suffer. These men often know little of belting and its applications. They start off with the wrong belt for the job and use it in the wrong way and wonder why they have trouble. The belting situation is in a chaotic state in the electrical industry, which means in almost every industry, because electrification is fast occurring in every phase of manufacturing and commercial endeavor.

The way to overcome this unfortunate state of affairs, and there is an excellent opportunity now, is to carry on educational work among the central-station engineers, as well as the electricians and superintendents of industrial plants. These men should be told about belts, their manufacture, selection and care. With the belt such a common sight, and such an important link between the driving and the driven machinery, the power house and customer, it is difficult to understand why so little has been done when so much might be done to advantage of all and when it could be so easily accomplished.

Central Station and Belt Drive.

C. J. Carlsen, power engineer, Commonwealth Edison Company, then spoke of the situation as viewed by the power salesman or engineer of the central-station company, who stands as the consulting engineer for the utility and frequently for the customer. He pointed out that in his work, for example, the belting men overlook coming to ask for specifications, to ask what is needed, or in fact what is going on. The belt manufacturers have never sent him any data or information on belts or their application. About the only thing he ever sees about belts is what he looks up for himself. This is a pity, for belting is as important as copper in the industrial central-station load. There was, years ago, a strong effort, on the part of some zealots, to direct connect wherever possible, a movement initiated when the electric motor first came into the limelight. However, experience has shown that direct connection has its sphere, a comparatively restricted one as compared with belt drive.

The work of the central station comprises not only generation of power with prime movers from which the belt has been largely eliminated but also distribution and utilization. In this latter there is a vast demand for belting, a demand increasing each year at a rapid rate. For most power purposes, the belt constitutes the final connecting link between company and customer. It is not connecting the meter that brings in the income. It is connecting the load to the motor and keeping the load going. The situation in Chicago is most illuminating in this respect. The Commonwealth Edison Company has approximately 20,000 power customers; 18,000 customers have a connected load of 10 horsepower and above, the remaining 2000 have less than 10 horsepower. Of the 18,000 customers with their 500,000 horsepower in motors, 400,000 horsepower is connected by belt. The industrial field is a very wide one and covers almost everything in the way of motor drive.

Steam-driven appliances, as ammonia compressors, air compressors, etc., when replaced by motor drive cannot usually be direct connected. The necessary speed for economical design and standard motor are unsuitable; the foundations are not suited and in other ways belt drive is almost invariably compulsory. In Chicago there is 12,000 horsepower in ice and refrigerating machinery connected up to central-station service. Of this less than 500 horsepower is direct connected, the remainder being belt driven. In the ordinary ice plant containing compressor, brine and water pumps, agitators, and auxiliaries less than 10 per cent can be direct connected, and for other reasons less than this amount is usually direct connected. In taking over these plants, of which seven were connected up last year, the customer invariably asks the central station where to obtain belting, what sort of belt to get and how to treat it.

The central-station engineer has wider experience than the average consulting engineer. He also has the benefit of the experience and ideas of others similarly situated, and extending from coast to coast through the interchange of ideas. But these engineers do not ordinarily come closely enough in contact with belting salesmen to give personal attention to belting problems. The selection of belting thus goes by default to purchasing agents, and customers may buy their belts through this channel. Purchasing agents know little about belts, only about their prices.

At present 80 per cent of the industrial load in Chicago is belt driven, and the tendency seems to be to maintain this proportion rather than lessen it, based on 18 years' experience of the speaker. Even tanneries, which might be expected to adopt direct drive wherever possible, as their belts have higher market value than when used by themselves, are large users of belting.

When a motor replaces some other form of drive it usually means a new belt goes in also. A new plant means new belting. In one recent case in Chicago a load of 4000 horsepower was connected up to central-station supply. There were 150 motors altogether and not a single direct drive, but all belting. Experience shows that electrification of steam plants means additional belting, almost invariably. And practically every customer connected up asks about belting and requests advice.

Commenting on Mr. Carlsen's talk, F. A. Merkel pointed out the surprisingly vast field for belting in the industrial plants reached by the central stations. There is urgent need for educational work to improve the care and maintenance of belts, also data on belt engineering. Belt manufacturers and belt jobbers need to get in touch with the central-station power engineers, and thus do away with much of the misunderstanding and round-about dealing now in vogue. To do so means the right belt and right drive for the right job, which in turn means satisfaction. He also referred to successful means of collecting data.

Ashley P. Peck, consulting engineer, New York, said the meeting had emphasized the need, first, of education on belting engineering, secondly, the necessity for standardization. The belting situation is in a befogged state; the belt manufacturers too frequently know little of exactly what their belts are to be called upon to do; the user knows next to nothing about the best belts for the purpose; the central stations are apt to leave the belting to jobbers, who care little so long as they make a profitable sale. A belt is ordered by a user, who guesses at width, at tension, at the number of ply, length, and arc of contact, etc. Reference to belt manufacturers' catalogs shows them almost all the same, except for discounts. The fallacy of direct drive has died hard, but it is now recognized that direct drive and belt drive each has its place for maximum efficiency and most economical performance. There is crying need for education as to choice of belt and maintenance of belting. A large loss is being suffered due to mistreatment of belting by oil-soaking, overstressing, warping and improper splicing and careless hanging.

Victor A. Seuberth, district manager for the central states, of Charles A. Schieren Company, said the basic error is being made by salesmen wanting to obtain orders irrespective of belt application. Belting is not sufficiently standardized, data on belt performance is scarce and incomplete and what does exist is not easily compared. Hides individually vary widely; hence results of tests also vary over a wide range, making standardization practically impossible. It is to overcome these things that Charles A. Schieren Company developed its engineering service bureau. The

purpose of this bureau is to assist present and prospective belt users, instruct salesmen and further the interests of belt engineering by educating salesmen and users as to the choice of belt, its service, treatment, etc. Salesmen are told when they make mistakes and thereby learn their lesson. The purpose of this bureau is to help, not scold. The company aims to render service in its wide sense, often a difficult matter because the purchaser is not unlikely to be suspicious and uncommunicative.

Catering to the electrical field has been difficult. Direct drive has been advocated and assertions made that the belt was passé; high speeds, incomplete data on requirements, too narrow pulleys and too small pulley surface have added their quota to the troubles. Motor manufacturers should be asked to fit their motors, when required, with wider pulleys, so often recommended by the company's engineering service bureau as the solution to belt troubles. Many troubles blamed upon the belt are due the pulley. Equipping a motor with longer shaft and wider pulley would cost little additional, but would make considerable difference in belt performance, life and upkeep cost. On many occasions his company has refused to supply belts because the pulleys on the motors were incorrect and jeopardized belting performance. Much belt trouble results from master mechanics, foremen, and plant operators furnishing incomplete information as to requirements or as to cause and effect of difficulties encountered. Mr. Carlsen here remarked that standardization of pulleys should present no difficulty since the other end of the motor is standardized, namely the conductors or motor leads. Wire sizes are fixed, why not pulley sizes? As a matter of fact, in electrifying industrial plants his company usually specified the diameter and width of pulleys, a condition largely fixed by speed of driven machine.

C. W. Forbrich advocated taking the matter of pulley sizes up with the Electric Power Club, which could approach motor manufacturers for closer cooperation with the belt manufacturers.

Mr. Seuberth then discussed briefly the various materials used for pulleys, namely cast iron, pressed steel, hide, cork insert and paper, mentioning the work now in progress by the Mellon Institute of Industrial Research. The variation in quality and characteristics of belting with the cut of hide of the same and different animals was covered—matters of importance regarding performance, and a great hindrance to standardization of tests and results.

J. E. Montgomery, publisher of Concrete Products, brought out the point that electric drive means really the most important drives in practically all industries, since electric drive is used universally. He detailed some of his own observations among cement,, gypsum, lime and concrete products plants.

Belting in Cement Mills.

H. W. Young, New York, as Eastern manager of Engineering and Cement World, gave a talk that surprised and deeply interested all his listeners. There are some 125 large cement manufacturing companies in this country and Canada, operating 165 plants, without taking into account smaller concerns. Although comparatively few in number, these plants are among the largest consumers of power among the industries. These cement mills' power plants average around 3000 horsepower each, making a total of nearly half a million horsepower for the industry.

In cement production power is a large item, used in the most part for driving heavy machinery. The process of cement production is such that a constant stream of heavy rock is reduced to an impalpable powder, necessitating a large expenditure of energy, largely by belt transmission. The electric motor is used almost exclusively, using belt drive to a large extent. To indicate the large amount of belt required by cement mills, in one Iowa plant with a capacity of 6000 barrels per day, electrically operated by its own plant of 3000 kilowatts, 126 motors are used, aggregating 6385 horsepower. The yearly expenditure for belts for driving the machinery alone in this plant was from $7000 upward. In another case with which the speaker is familiar, where one company operates seven plants, some medium size and some large, the bill for belting amounted to $140,000 per annum, or $20,000 per plant per year. Approximately one-third of this was for leather belt.

Considering $10,000 as a conservative estimate of the yearly expenditure of belting per plant, the annual expenditure for the cement industry would be in the neighborhood of $1,500,000, a large sum when distributed among comparatively few plants.

In a small Michigan cement mill, producing 1500 to 2000 barrels a day the speaker was able to determine the exact amount of belt in use, and its size. There were 115 belt drives, partly from individual machines, and partly from line shafting. The belts ranged from 18 inches down to 3, the latter being for machine shop work. The most frequent sizes were 8, 10, 12 and 14 inch. The lengths ranged from 91 down to 20 feet. The total belt of all widths was 5178 feet. In this same plant there were 12 belt conveyors, the longest of which was 405 feet, 18 inches in width; the shortest 39 feet and 8 inches in width. Altogether there was 78 feet of 8-inch conveyor belt, 1068 feet of 18-inch, 192 feet of 20-inch, 143 feet of 24-inch, and 111 feet of 26-inch, making a total of 1592 feet of conveyor belt.

Cement mill operators keep closer tab on equipment costs than almost any other industry, and carry this down to the smallest detail. Cement production cannot be haphazard, and scientific accuracy is required at every step. Chemical analyses are made hourly at various stages, ingredients are weighed and apportioned exactly; laboratory tests are made for fineness, chemical content, tensile strength, etc. To keep tab on the belts and equipment with the same accuracy comes naturally and may be accomplished easily.

This explains why cement mill records show the time when every machine, motor, elevator, every foot of belt was bought, placed in service, the price, and mill-hours at which it has operated. The cement mill operator knows exactly the belt and belt dressing or whatever it is that gives most satisfaction; and he knows exactly its performance in the way of upkeep and life. Under the circumstances belt may be bought on merit, for the cement mill operator wants a belt that gives lowest cost per barrel of cement produced, and that possesses long life.

H. W. Neal, sales manager, Imperial Belting Company, in a most illuminating talk, explained that his company manufactured fabric belt, not leather, that each had its field, which while sometimes overlapping might be quite distinct. In making belt his company aimed at turning out belt of quality rather than low price. Sales were about 50 per cent transmission and 50 per cent elevator and conveyor. During years spent in the jobbing and supply business, prior to the present connection, many wrong applications of belting have been encountered, due chiefly to selling belt direct to the consumers for their supposed requirements. This emphasizes the value of selling through sales engi-

neers, who are interested in putting the right belt in the right place.

The remarks of previous speakers apropos pulleys applied to almost all machinery, although machine tools and similar apparatus has because of its wide use proved the mistakes of improper pulley sizes. It is far cheaper to have wider pulleys in many cases than usually supplied with a motor. Co-operation between belt manufacturers, machinery manufacturers and electrical men is to be earnestly advocated. Meanwhile if a belt gives trouble or does not accomplish what the user expected it to accomplish, the belt receives the blame, whereas it is usually a matter of abuse or misapplication. The case of a large powder plant was cited, where a belt for 100 horsepower was used for transmitting 180 horsepower with the same result that would have ensued whatever make of belt used, yet the powder company would not change specifications.

The importance of testing was also touched upon by Mr. Neal and the accessibility of the C. W. Hunt Company's testing facilities in Chicago and vicinity was brought out.

I. L. Kentish-Rankin, testing engineer, after corroborating the need for such work pointed out that selling belt was in a chaotic state. Some is sold by jobbers, some by manufacturers to users direct, some through engineer salesmen and so forth. The chances were greater that the wrong belt was sold rather than the reverse.

Some interesting instances were cited where belt drive had enabled a difficult situation to be overcome because of unsuitable foundations for the driven machine. In one instance direct drive had been impossible because of excessive vibraton due primarily to the foundation alone, in others the vibration to the foundation caused other oscillations to be set up approaching resonance, leading to trouble and necessitating radical changes in the foundations or the use of belt drive. These experiences are not uncommon when converting engine-driven units to motor drive. Another point, some forms of direct drive are such that a thrust bearing is required unless frequent repairs and adjustments are not to be made. Belt drive, by parallel shafts instead of shafts with their axis in the same straight line eliminates this. In any case the belt is a valuable means of connecting up whatever motors are on hand, since requisite speeds can be so easily obtained. A flexible coupling in the form of a belt is often a great time saver sometimes. A slipping belt with its noise gives indication of trouble somewhere. With direct drive either a fuse blows or the motor may burn up, hence belt drive may save many a shut down. In numerous cases the output of a machine has been increased quite simply by connecting up a larger motor through a belt, where had direct drive been used or retained difficulties in the way of speed, clearances and shaft levels would have been costly to surmount.

Victor A. Seuberth deplored a tendency on the part of some jobbers to want all and give nothing. For this reason his company has attempted to sell belt direct to user or purchaser. The jobber often sells any belt irrespective of proper application, with the unsatisfactory results to be expected.

E. G. K. Meister, speaking for O. W. Crawshaw, Vice-President, Charlotte Belting Co., took up the sales policy of this company in marketing belting. Mention was made of cultivating the jobber, but also going direct to purchaser. The belt manufacturer can solve simply many a problem complex to the user, and only for the asking. The central-station engineer actually handling belting is usually difficult to reach. The manufacturer does not know whom to approach, nor how to reach him. The engineering department may be the wrong department; the purchasing agent may be the right man, but the larger the company the greater the likelihood that he is not; likewise the greater the difficulty of finding who is the right man. The problem of selling would be solved if the right man could be reached, and it is to reach the right man in every case—the man with the ability to recommend, advise and consider—that the technical press through its publicity, trade activity and advertisements, is so efficient. The technical press reaches the trade, it is the medium through which the manufacturer or the jobber or both are able to reach the purchasing power of the central-station industry, and through it the industrial plant on central-station service. Similarly, where isolated plants furnish the power, the man in charge of operation can be communicated with through the paper of his industry, which he must read and does read regularly to keep in touch with modern conditions. It is while going through their pages that his mind is most receptive to suggestions made by real advertising copy. He is not looking for entertainment, but for facts; facts which will give him a better grasp on his business; facts which mean efficiency and greater economy; facts which point the way to larger, surer profits.

Continuing the line of discussion opened up in the conclusion of Mr. Meister's talk, H. W. Walker, general manager of the International Trade Press, reviewed briefly the scope and power of the technical press, and the influence it wields. The technical press is the link between manufacturer and consumer. It is able to go, and prove effective, at all times and in places where no salesman can reach. It is studied and discussed, where no salesman's plea would be listened to or considered. Both the reading and advertising pages of a first-class technical periodical are a source of education and an inspiration for the wide-awake engineers, purchasing agents and companies' officers. It is used for instruction, for keeping experience up to date, and for reference, influencing a vastly larger number of interested persons, most of whom are vitally concerned, than any sales force could hope to reach even at prohibitive cost. The technical press is the medium by which the progressive manufacturer reaches his markets. It is the channel by which the wide-awake company's officers keep in touch with competitors, know what its rivals are doing and stays close to the users of material or equipment. It is the authoritative channel followed by those that want to sell and those that have to buy.

B. F. Horstings, vice-president of the Moloney Belting Company, was much impressed by what had been said by previous speakers. Mr. Seuberth had hit the nail on the head when saying lack of knowledge on use and application of belt by the user and absence of knowledge of what the belt was to be used for by the manufacturer were sources of trouble. Ignorance, suspicion and competition tersely explained the situation as it was today. To cite an instance. A belting job was contracted for although the belt requested was known to be the wrong size. However the customer wanted it. When complaint was made the proper size was installed, and after many years was still running. This is one of hundreds of cases where the right belt gives absolute satisfaction, the wrong belt ceaseless trouble. It is really a matter of applying a particular belt to a particular job. In another instance a job was bid on but the price was too high. Five times within six months bids were asked by this same purchaser, and each time the price was raised,

and turned down because too high. However, eventually the prospect ordered the belt, at its highest price, with a guarantee that this belt, while nominally rated for 600 horsepower, would transmit 750 horsepower, or 150 horsepower overload, for one year. The belt was for emergency service. The occasion arose and this 30-inch belt remained in service for one year, transmitting 750 horsepower.

Leather belt is unlike metal or wood. What is done after the belt is in use determines largely its performance and life, factors beyond the control of the manufacturer, but for which he is often held to blame. Few realize outside of the belt manufacturers the effect of motor drive upon machine performance and the belting problem. For example where a wood planing machine once would have a 4-inch belt and would plane 40 feet per minute, planing on two sides, now 300 feet per minute and planing four instead of two sides is common, making the belting problem a difficult one.

Co-operation between manufacturers and the technical press, the distribution of information and news, heralding of new enterprises and new methods is alike of value to the manufacturer, the subscriber and the paper. All benefit. While the technical journals specialize in various things few deal at all or only a little of belting, its care and treatment. There are not many other cases where information is so scarce, and so difficult to get. The speaker had endeavored to obtain authoritative information from Illinois, Purdue and Cornell universities and other similar sources, to no purpose. The information did not exist. There is an imperative need to arouse interest amongst belt users, one that would be of profit both to them and to the manufacturers, who desire to sell good belts for the work they are to be put to.

As typical of the various ignorant conceptions regarding belting there is perhaps no greater fallacy than that as to the location in the hide for obtaining leather for the best grades. The back of the animal is usually specified, whereas it would be better to tell the manufacturer what the belt is to be called upon to do and allow him to decide what belt to furnish. Some positions of the back of the animal are frequently horny, and instead of being the best cut of leather for all purposes are often for some purposes the worst. The purchaser who always specifies hide from the back in many cases may be injuring his own cause.

The chairman expressed his pleasure at the interest aroused during the meeting. The discussion had far exceeded expectations, as regards the amount of information brought out and the scope of the movement which it presaged. The belting manufacturers, generally, had promised their enthusiastic support, which he in turn could pledge for the technical press. Without exception those belting manufacturers unable to be present had requested they be kept posted as to future meetings and of what had transpired at the present meeting.

Letters and telegrams were then read from belt manufacturers and representatives unable to be present, sending their regrets and requests to be kept informed of what transpired, as well as promising their sympathy with the movement and their moral support. Among these were regrets from W. T. Plummer, president, and J. W. Cullen, western manager, Main Belting Co.; C. H. Dankmeyer, general sales manager, Gandy Belting Co., who was, however, very ably represented by Messrs. Gothberg and Boone of the W. D. Allen Mfg. Co., and C. G. Neff, president of the Bradford Belting Co. At the last moment word came from Edward H. Ball, vice-president, Chicago Belting Co., that he was prevented from attending on account of the mortal illness of the company's president, Charles Allis. Sickness also caused the absence of E. E. Bosworth of the Graton & Knight Mfg. Company.

At the suggestion of Charles Schieren, seconded by W. F. Spaulding, secretary of the Graton & Knight Mfg. Co., an invitation was wired to L. W. Arny, Philadelphia, to address the next meeting.

In concluding the meeting, after dinner in the Chicago Athletic Club, C. A. Tupper, president of the International Trade Press, Chicago, who had acted as chairman of the preceding session, referred to some of the broader phases of the subject.

In the vast fields of transmission of power and the handling of material by belting there is room for all, need for all, while co-operation is desirable for the good of all. And the more designers and consulting engineers, such as those present, know about belting and belting applications, the better can they help their clients and the belt manufacturers. At a future meeting it was intended to present the views of some very large belt users, as well as both domestic and export distributors. It is a subject of commercial interest, however, to the smallest as well as the largest user of belting, for hides and leather, rubber and fabrics are of prime national value. Moreover, chaos cannot persist where standardization is coming so rapidly in all phases of commercial and industrial life.

There are also larger aspects of this matter, engineering, economic and patriotic.

Reconstruction work, involving preparation for conditions after the war, has already received deep and careful thought amongst our allies. Committees in London and New York are already compiling all essential facts in relation to the world's business houses, cross indexed for various interests and subsidiaries, giving the names of officials, directors and affiliations. When the war is won, and American, British and French capital take the place of our enemies', standardization of effort will be imperative indeed. "Set our own house in order" should be the slogan in the commercial and industrial world today before the time arrives when the trade of the world is pooled among those nations that have earned a commanding place among civilized races. It is then that the enormous productive capacity of this country and its allies must be turned into the channels for which they are best adapted, with least disturbance and loss of time.

In visiting many plants through the eastern and central states, and from a canvass of manufacturers by the International Trade Press, it appears that the thought uppermost in the minds of all is the urgent need for stabilizing trade so that it may continue on the best basis, not only now but also after the war is won. The standardization of belting, and bringing order where there is now chaos, as had been discussed by those present, is only one of the things waiting to be done. What has been going on for years cannot be changed in a day. But a start can be made, and must be made if we and allied nations are to assume and maintain the status earned and necessary when victory is ours. It is for this reason that the meeting had been called by belting men and engineers interested—only a beginning but an auspicious one. That this conference should have received the support of so many of the leaders in the field augers well for future meetings and for the spirit of co-operation and attainment that the discussion had forecast.

Electricity in the Manufacture of Automobile Tires

Second Installment—Choice of Energy and Salient Features of Control, as Applying to International India Rubber Corporation's Plant, South Bend, Ind.

By B. B. JACKSON

Sales Engineer, Fairbanks, Morse & Company.

BEFORE the advent of the variable or adjustable speed motor calender rolls were ordinarily driven from a line shaft, two speeds being provided by an arrangement for changing gear ratios. At the present time motors have been developed with sufficient range of speed variation to cover the entire range of speed variation required for the most effective operation of the rubber calender. As the best speeds for various heats on the calender will form a continuous scale from the lowest to the highest speed, the mechanical gear with its two speeds does not meet the requirements, and no mechanical speed-changing device covering innumerable steps over a wide range has ever been developed that could compete with the variable speed motor for cheapness, durability, effectiveness and ease of operation.

The most desirable type of motor for driving the calender rolls is a shunt-wound, direct-current, adjustable-speed motor, but the selection of a motor must, of course, be made with due consideration to the characteristics of the power supply available. In most districts where rubber plants are likely to be located the supply of current is more apt to be alternating than direct, so that the use of a direct-current motor will usually involve the expense of some apparatus, such as a motor-generator set, or a synchronous converter for changing from alternating to direct current.

The desirable speed range for calender rolls is 4:1. It is possible to get this range with a slip-ring alternating-current motor, provided the motor is running under approximately full-load torque at the low speeds. A bank of grids about 4 feet square and 6 feet high will be required as secondary resistance in the rotor circuit of the motor to obtain the 4:1 speed variation. In a drive by this type of motor there are three characteristics of inferiority and only one of superiority as compared with the direct-current motor. This motor has the advantage of much lower first cost, but has these disadvantages: (1) enormous waste of power; (2) variation of speed with load for a given controller setting, making the getting of proper speed for a given kind of work a matter of cut and try; (3) less number of speed steps and not so conveniently applied.

In some plants where several calenders are used it has been found feasible to employ slip-ring motors with 2:1 speed control for individual drive by using one machine for "sheeting" only and another for "frictioning" only, etc., thus reducing the speed range required on an individual machine to that required by one particular process. But even this method still has the objection that there is considerable waste of power and a certain amount of undesirable speed variation due to unevenness in the load, which produces an unevenness in the product coming from the machine.

Where direct-current electric drive for the calender is used the higher first cost of the equipment, which may include apparatus for producing direct from alternating-current supply, is offset by higher electrical efficiency and the attainment of almost ideally convenient and perfect speed control. The latter is especially important, as it will add to both the quantity and quality of production on the calender.

The necessary 4:1 speed ratio may be obtained with direct current by the use of a 4:1 adjustable speed direct-current motor operating on a simple single voltage circuit or by a 2:1 adjustable speed direct-current motor operating on a three-wire double-voltage circuit, such as the well-known three-wire Edison system, with, say, 115 volts from the middle neutral wire to either outside leg and 230 volts between the outside wires. The method of speed variation by varying the voltage applied to the motor through manipulation of a rheostat in the generator field has the objection that a separate generating source is required for each calender motor in plants having a plurality of such machines. As a result, manufacturers have not devel-

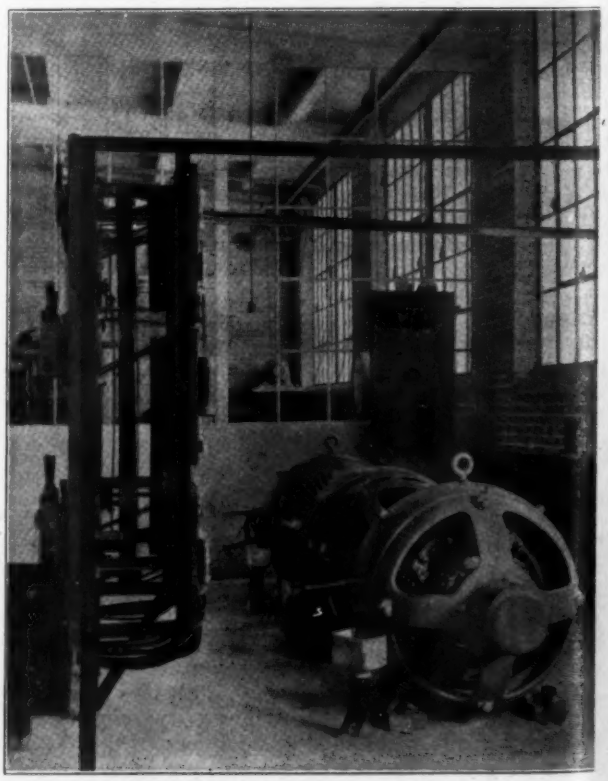


Fig. 6.—Interior View of Motor-Generator Room, Showing Switchboard, Two Generators, and Motor.

oped suitable standard control apparatus to handle such installations in plants requiring but a single unit where the conditions would be adapted to that method of control.

Preference was given to the double-voltage direct-current method of drive at the South Bend plant mainly out of the following considerations: Firstly, equality in first cost as compared with single voltage, since the higher cost of a 4:1 motor for single voltage would offset the higher cost of the double-voltage generating equipment for use with a 2:1 motor; secondly, equality in cost of operation of the single and double-voltage methods; thirdly, greater factor of safety as regards stability of operation in favor of motor with 2:1 speed ratio; fourthly, ability to change from low to high speed and vice versa by push-button control in reach of the operator at the calender; fifthly, twice as many speed points in favor of double voltage, as use of the full range of speed points on the field rheostat of the motor may be repeated for each voltage.

In deciding upon the use of a double-voltage drive for the calender it was necessary to consider whether it was best to use a three-wire synchronous converter, a motor-driven three-wire generator set, or a motor-generator set having two generators in series, for converting the 3-phase, 60-cycle, 220-volt supply to 115/230 volt direct current for application to the calender motor.

As the regulation of the three-wire synchronous converter or the three-wire generator would be rather poor with the total load on 115 volts, due to the impedance of the balance coils, preference was given to the motor-generator set having two generators in series, one of which would carry the total load on 115 volts with the same degree of regulation as when both generators in series were carrying the total load at 230 volts. The total load at 115 volts would ordinarily be one-half the value of that corresponding to 230 volts, since the calender will operate only one-half as fast on the 115-volt speeds, and the calender load is one of practically constant torque.

While the question of regulation alone on 115-volt loads would throw the balance in favor of the two-generator method as compared with the three-wire generator, as compared with the synchronous converter, the advantage of superior regulation with the two generators is somewhat offset by the higher over-all electrical efficiency of the synchronous converter. But as compared with the synchronous converter the method selected also has the following additional advantages: (1) opportunity to adjust direct-current voltage to the desired value should the alternating-current service supply be abnormally high or low; (2) the motor-generator set, as selected, consists of an ordinary alternating-current motor and two ordinary direct-current generators, units with which any ordinary electrician is familiar with, and therefore can be relied upon to give a high standard of service.

Operation of Calender Motor Automatic Control.

To start the motor the line switch Im and the reversing switch Hm (referring to Fig. 8) are closed. Then with the safety switches Fm, Em, Dm and Am in the running position, the motor will start and continue to run by pressing the push button of station Bm, only a momentary contact being required. If, however, Am is set for inching, the motor will start upon pressing Bm, but will stop as soon as released. This operation can be used to advance the rolls an inch or less at a time, as in threading and similar operations, to get the work started through properly. If the motor is running it may be stopped by operating any of the safety switches Fm, Em or Dm, or by turning Am to the "Stop" position. The motor then cannot be re-

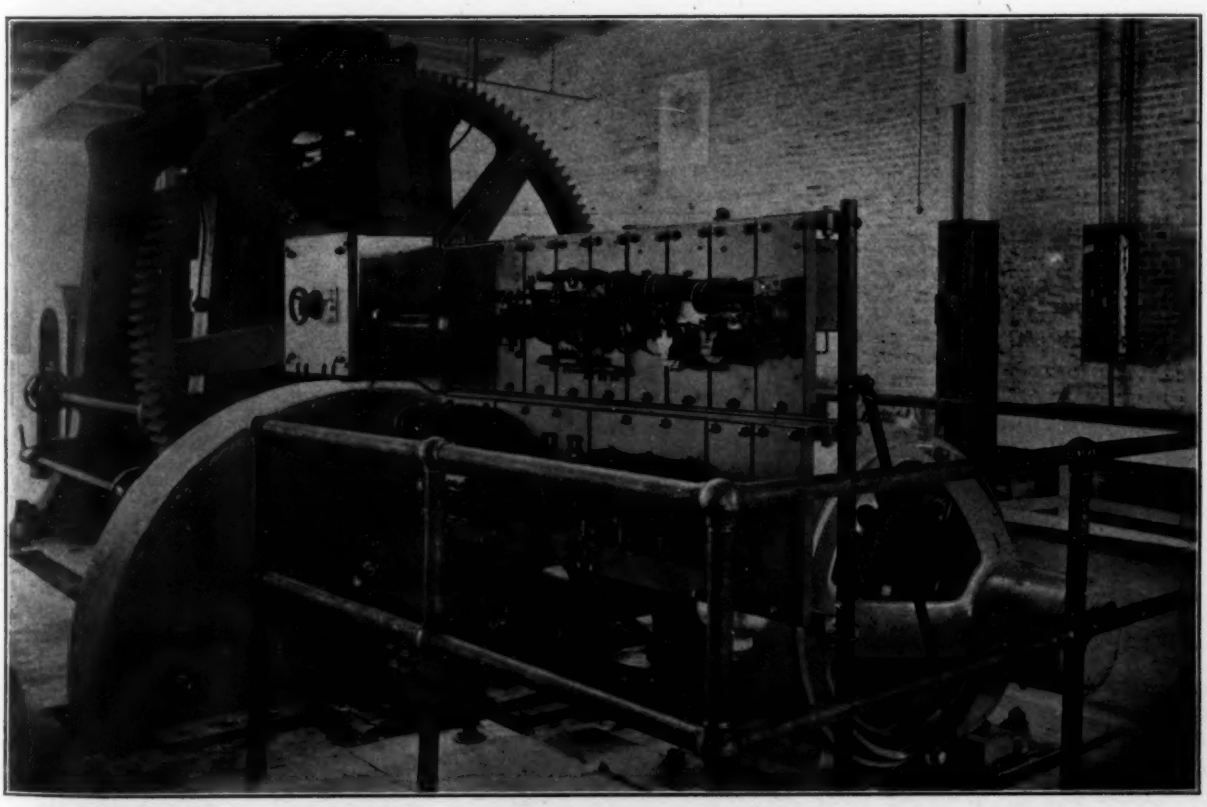


Fig. 7.—Contactor Control Board for Calender.

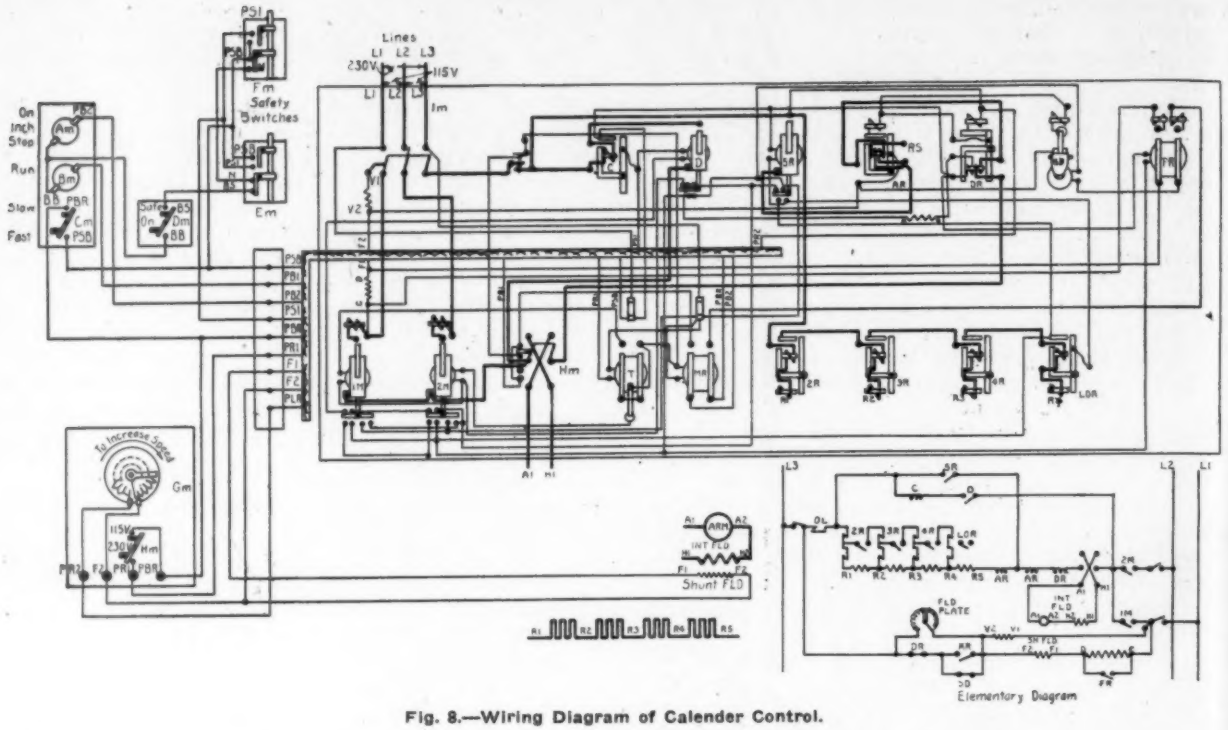


Fig. 8.—Wiring Diagram of Calender Control.

started so long as any one or more of the above switches are in the stop or safety positions. Am, Bm, Cm, Dm, Fm and Em are mounted at convenient points on the calender. Gm and Hm are mounted on the control panel. The foregoing eight stations are manually operated, while all the remaining apparatus on the control panel operates automatically by means of electromagnets. On the panel are two circuit breakers, 1m and 2m, which control the application of the high or the low voltage to the motor. If Gm is set for 230 volt, 1m will close upon starting the motor. If for 115 volts, 2m only will close. The push-button station Cm is employed to change the speed a given amount according to the setting of the field rheostat at Gm. Thus pushing the fast button cuts in the field resistance, speeding up the motor a predetermined amount while pushing the slow button short-circuits the resistance, causing the motor to slow down to its normal full field speed. The above operations apply whether the push button Gm is set to operate at 230 or 115 volts. Still further speed changes with finer gradations can be effected by use of the field rheostat Em. The safety switches Fm and Em are operated by a cradle attached to the projecting shaft and running the length of the machine just above the operator's head. The two switches, each with its cradle attached, are placed on opposite sides of the calender. The cradle has three positions, namely, middle, up and down. The middle is the running position, down effects an ordinary service stop, while up effects a quick stop by dynamic braking, accomplished by short circuiting the armature of the motor through a resistance by the closing of the magnet switch. This control was especially designed by the Cutler-Hammer Mfg. Company for this installation.

Power is furnished to the 90-horsepower motor driving the calender by a motor-generator set consisting of one squirrel cage 150-horsepower induction motor direct connected to two 125-volt shunt-wound, 50-horsepower direct-current generators, connected in series to give the required double voltage of 125/250 volts. The installation of this motor-generator set is shown in Fig. 6.

Operation of Mixing Mills Through Magnetic Clutch.

As the mixing mills do not require speed variation, it is advantageous to drive a line of such machines by a shaft underneath at the floor level, which carries sliding pinions for engaging the large gear wheels of each mixing machine. While such a slidable pinion enables any one or more of the mixing mills to be thrown out of gear when their service is not needed, the method of stopping is too slow to be of any value as a safety device. The best provision for safety would require that any mill in the line could be stopped quickly by some means within easy reach of the operator himself and by the same means in easy reach of the operator of any other machine.

The above requirements are met most perfectly in inserting a magnetic clutch and brake between the

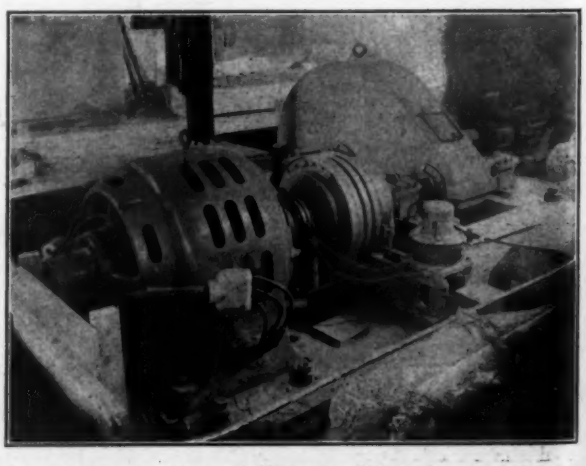


Fig. 9.—Close-up View of Magnetic Clutch Coupling 200 h.p. Motor and Mixing Mills.

motor and the first mill in the line. Cradle-operated stop stations are provided at each mill for breaking the circuit energizing the magnetic clutch. Fig. 2 shows the magnetic clutch installed, also the induction motor driving the mixing mills in the background. In Fig. 9 is shown a close-up view of the magnetic clutch, showing the electrical connections. It may be noted that a stop for one mill means a stop for all when effected through the magnetic clutch, but that is not objectionable in emergency stops. Attached to the shaft on the driven side of the clutch is a brake wheel which receives a brake band. This is tightened by the falling of a weight when magnetically released by the breaking of the electric circuit at a stop station. Thus the brake is automatically applied the instant the magnetic clutch is released.

Electrical energy is purchased by the International India Rubber Corporation from the Indiana & Michigan Electric Company. Energy is delivered at 2300 volts, where it is stepped down to 230 volts for general distribution around the plant, by three 100-kw., single-phase transformers. At the present time the plant has an output of 350 auto casings and 250 inner tubes per day. With a few additions to the equipment the capacity could be increased to 500 casing and 400 inner tubes.

The International India Rubber Corporation's plant is typical of not only tire factories but also rubber factories. Alternating current is usually preferred for general application because of its ease of control and transformation and the adaptability of the rugged induction motor for the types of drive. At the same time, direct current with its wider range and closer control makes it ideal for calender drive. The synchronous motor-driven motor-generator set, and the synchronous converter are both used for power-factor correction in many such cases.

WAR BY CIVILIANS.

Abstract of an Important N. E. L. A. Paper Reviewing Effect of War on Business and the Duties of Business Men ond Other Civilians.

By Arthur Wright.

Notes on the above subject by an Englishman may interest the members of the National Electric Light Association, and assist to shorten the inevitable time-lag existing between the declaration of war by a big nation and the real entry of its people into it. That it took the British people nearly two years to realize the big thing they were up against, that even today many parts of Great Britain and Ireland are practically unaffected by the war, shows how difficult it must be to set the bulk of American civilians (with a camouflage of more than 3000 miles to blind them) to visualize what this world war really is.

No people can be said to appreciate the gigantic problem their government has in hand until they themselves believe that war should be the dominant topic of interest; that all talk of "business as usual" is not merely unpatriotic, but grossly unfair to their fellow-countrymen fighting under awful conditions at the front; that all discussions of after-the-war problems, peace terms and questions of reconstruction should be for the time being tabooed, as being premature and of secondary interest. Until the majority of men and women who count are trying to concentrate their mind on their best way of helping the country in this unique war for their liberty and rights, they really cannot have any true idea of the stupendous work that the Governments of the Allies have in hand.

The draft will relieve many of the younger men of the problem as to how to help their country. It is time for the remainder of us to realize that the war may last some years longer, and a still longer period must elapse after the signing of peace before business can be expected to resume its normal course; that, unless the world conflict is to drift on indefinitely, a time will shortly arrive when every able-bodied citizen should find a proper sphere for his war activities; that all talk of a man's individual business or property being damaged by the war indicates selfishness and inexcusable ignorance of the real sacrifices men at the front are making, in comparison with which any loss we civilians may suffer must be considered as negligible.

While there can never be equality of sacrifice between that offered by our soldiers and sailors and that made by the civilians working at home, some approach to equality of usefulness between the two groups can be attained, if the civilian will at once bring himself to believe that the only thing that really matters now is the successful prosecution of the war.

Without suggesting any increase in the innumerable army of Government officials, committees, or departments by good hearted co-operation and discussion, much useful work may be done in strenuously combating many prevalent and pernicious illusions such as the following:

Illusions to Be Fought.

(1) The war cannot last much longer.
(2) Business must be carried on as usual.
(3) The war will necessarily ruin most businesses.
(4) Civilians need do little on their own initiative, as the Government will in due course call for all the help needed.
(5) Owing to the terrible tragedies that are daily being enacted on the battle front, it is both unpatriotic and unfeeling to preach cheerfulness and optimism as to the future.

Taking these common illusions seriatim: The idea that the war will not last much longer seems as prevalent today as it did three years ago. Most of the reasons for this extraordinary belief are of an extremely vague nature, such as that the belligerent nations cannot stand the strain much longer. Curiously, most of the propagandists of this "short-war" idea admit simultaneously that the defeat of the Allies is unthinkable and that Germany up to now has had most of the military successes.

As America and her Allies can never contemplate final defeat at the hands of Germany and as the German people seem at present quite convinced that their military organization must continue to be victorious, it is obvious that a very long time must elapse before the Allies become strong enough to inflict a really decisive defeat on the enemy or before the well-disciplined German people are forced to recognize the certain ultimate failure of misdirected force against the might of right when supported by the people. The real leaders of Germany today, viz., the Prussian military autocracy, have nothing to gain and everything to lose by accepting the Allies' terms of peace. Why, therefore, with this militaristic crowd still in absolute power, should they commit hari-kari, or, why should Germany contemplate today any compensation for the terrible wrongs to the weaker nations that she has trampled on?

The idea of an early peace has also been stimulated by the many attempts which the enemy has made to negotiate peace while she still enjoys a military success. Her reasons for wanting peace now are

so transparent and contrary to those which will govern the Allies in framing their peace terms, that not even a vestige of an allied peace is yet in sight. Again, the idea of a proximate termination of the war seems curiously prevalent among some of the leading representatives of all the belligerent nations, as shown by both the Allies and Germany in past and present discussions and by appointing committees to consider the many after-the-war problems that will ultimately have to be tackled. The fact that both sides are studying almost identically the same matters should convince us that the early peace anticipated by the Germans can only be consistent either with a decisive victory by them or with a patched up compromise with us, neither of which are the Allies ever likely to accept, although the alternative may be the protraction of the struggle indefinitely.

The next pernicious doctrine is "Business as usual." While this offspring of the "short war" illusion should be easily buried, its possible consequences in slowing down war activities are so serious that it is necessary to point out vigorously how, besides causing much mental suffering among the men in the trenches, the idea is the very antithesis to any and all speeding-up of preparation for war.

The fact that no business can or should be "as usual" does not carry with it the idea that many need be ruined, provided a complete rearrangement of methods and products suitable to the country's new conditions and wants is promptly worked out. In England the change in most businesses required by war conditions has been generally accompanied by a very marked increase in prosperity, due partly to the enhanced requirements for nearly all classes of manufactured goods and raw materials, and to the much higher wages earned by the working classes. The theory of businesses being necessarily ruined in countries not in the actual war zone is not borne out in England. Bearing in mind the enormous varieties of manufactured goods that go to replenish the war wastage and the fact that many of these cannot be turned out fast enough or early enough by newly erected national factories, but must consequently be produced by private concerns, it will be seen that most active manufacturers and traders should be able to use their skill and equipment very much to their own advantage, and that of their country first of all.

Effect of War on Electrical Industry.

The electrical industry forms a useful illustration of the stimulating effect of war on trade. Electrical power is now recognized as one of the most useful agents in producing the various kinds of war munitions. In most European countries an ever-increasing demand for power at much higher costs and rates than in pre-war days has been experienced. During the last three years, in England, the tremendous demand for all kinds of manufactured accessories has caused the Government to distribute broadcast huge orders for materials and articles among an endless variety of small engineering, woodworking and textile shops with the result that a wholly unexpected demand from them for electrical power, motors, cables, switches, lamps, etc., has occurred.

Unfortunately, the electrical utilities in the early years of the war, owing perhaps to the belief in its probably short duration and to the higher price of money, materials and labor, allowed their active and stand-by power plant and stocks of materials to get low and into a state of disrepair, so that when the demand for additional power came in 1916 and 1917 they were unprepared, in many cases, to meet it or began overloading the plant, with the usual consequences of frequent breakdowns. Some other electrical industries have not benefited by the war, such as those dealing in expensive lighting fixtures and luxury appliances, yet the manufacturers who have understood the altered conditions have not only benefited greatly by the war demands but have indirectly materially helped their country.

If public service commissioners can be convinced of the very essential nature of electrical power in war times and made to realize how seriously the present high price of fuel, plant and labor must affect the cost of producing electrical energy it surely should not be difficult to obtain their consent to raise the rates to meet these present higher costs. Utilities would thus be assured of a fair return on any existing or new investment required to meet the increased demand for supplying during the period of the war and the subsequent years of reconstruction.

There should now be no hesitation in adapting most businesses so that instead of having to face years of stagnation of trade, they may be prepared to participate in the increased demand for service, manufactured goods and raw materials which, owing to the requirements and the enormous expenditure of money by the Government and well-paid working employees of all kinds, must soon become acute in America. It should also be borne in mind that most of the money spent on munitions must very soon filter through to nearly all laboring members of the community. In Great Britain the working classes and their families never earned so much as they are now doing, with the result that luxury trades, such as jewelers, furniture, and musical instrument dealers, dressmakers, picture stores, etc., etc., are exceedingly prosperous, notwithstanding imposition of many restrictions, taxes, etc.

In regard to the fourth mistaken view that civilians need do little, the belief is very general that initiative in making men and women play their part in the war must solely rest with the Government, and that there are very few directions in which civilians can on their own initiative devote their abilities to the helping of their country. This is a very mistaken view for a democracy in such times, when besides fighting, governing, inspecting and manufacturing the ordinary munitions of war, there are very many other functions open to men and women, in addition to the well recognized and necessary work connected with the Red Cross and kindred institutions. Capable men and women are frequently met who are devoting a great deal of their time to some rather insignificant work in connection with routine clerical, police and mechanical Red Cross work, when if they or their advisers had the necessary initiative they could be of vastly more use by using their special capabilities in some definitely efficient direction.

As to the last subject in the list, cultivation of cheerfulness, as requiring a great deal of propaganda, the writer feels that only good can be done by persistently fostering a spirit of cheerfulness among all classes of the community at home, and showing them that although the war must continue for a long time, the Allies and the world must in the end win it. Pessimism in brooding over the terrible losses of the war and ignorantly criticizing the Government's conduct of the war, can only make its stupendous task harder and longer to complete. Any doleful tone today can serve no other purpose than to unsettle the morale of the nation as to the inevitable losses that are bound to occur in the titanic struggle between the belligerents.

Editorial Comment

Putting the Rivers to Work

THE GEDDES hydroelectric development described elsewhere in this issue deserves more than passing mention. The development is one of small power and low head; it uses the water that is used three times more in other small-power developments along the river; and each of these four plants individually and in the aggregate are but a drop in the bucket as compared with other stations on the same system.

The Geddes installation of the Detroit Edison Company some thirty odd miles from Detroit aggregates 1000 kilowatts, being the full development of the 15-foot head at this point of the Huron River. Between it and Detroit is another plant with 750 kilowatts capacity and a working head of 14 feet. On the up-river side of Geddes there are two stations, Argo and Barton, with 1100 and 1500 kilowatts and 12 and 22 feet head respectively. In Detroit the Detroit Edison has its two large steam plants, Delray and Connors Creek, with about 200,000 kilowatts generating capacity, which makes the four hydroelectric stations with their total of 4350 kilowatts look very small indeed. It is rather interesting to recall that soon after the two 500-kilowatt waterwheel type generators were placed in service at Geddes the 50,000-kilowatt turbogenerator at Connors Creek, the largest single unit machine in America, went into service with the same company.

The use of the same water four times, within a few miles of river travel, by four developments, each a small-power low-head development, is true conservation of water power, and a practice that might be employed far oftener than it is. It is a true conservation measure as regards coal and water, and may be made delightfully flexible. It might be pointed out that if the Detroit Edison Company when generating a kilowatt-hour on a minimum of coal, finds it worth using the small water powers within its territory, and incidentally thereby be enabled to increase its terrain, surely other companies with higher coal consumption could advantageously follow suit.

Hydroelectric development is, admittedly, not active at this time. If development, in the sense usually understood is restricted and handicapped, rehabilitation and improvement of existing developments, can, however, go on. It is extremely timely and advantageous that they should. There is many a hydraulic turbine, ten years old and more, that could be taken out and replaced with a prime mover of today, with a betterment of 10 per cent in efficiency. Doing so is one way of increasing capacity, and conserves water.

Throughout Minnesota and Wisconsin and other near-by states there is a general movement on the part of utilities, mills and municipalities to rehabilitate existing water powers by changing and modifying the turbines, the head, and operating at more efficient gate openings. "Putting one's house in order" applies as much today to the hydraulic plant as to the boiler room. Just as attention is now turned to saving coal, with the prospect that coal will no longer be allowed to be used wastefully or otherwise according to the whims of the user, so it is not beyond possibility that when attention reverts to hydroelectric development water will have to be used efficiently.

Development of Standardized Reflectors

MOST comprehensive development of an art is doubtless attained when there are no restrictions placed on its progress. This is notably true of the industrial arts, wherein it has been found that the wholesome competition of our modern industrial system results in extraordinarily rapid development of new discoveries and inventions. As these new ideas are worked out and perfected, it is found usually that certain applied forms of them meet the general requirements most satisfactorily. The final step in development is standardization of those types, forms, and sizes that most effectively satisfy what at this stage should be fairly well known and stabilized requirements.

An excellent example of such development is seen in the progress of incandescent lighting equipment in the last dozen years. When the vacuum type tungsten-filament lamp was brought out a considerable variety of types and sizes with varying characteristics were placed on the market by different manufacturers and the same was true to a somewhat less degree when the gas-filled lamp made its advent some five years ago. Careful and scientific study of the subject of lighting requirements, coincident with perfection of the details of lamp manufacture, soon showed that standardization of these lamps was not only possible but would permit concentration of lamp production on fewer types and sizes with marked advantage to the user as well as the lamp manufacturer.

While incandescent lamp production is now one of the most highly perfected branches of the electrical manufacturing industry, because it incorporates so largely the results of scientific research both as to manufacture and use, the closely allied branch of reflector production has until this year not made such great advance. From consideration of the lighting problem as a whole, it is obvious that there is no great advantage in having standardized incandescent lamps

when the reflectors with which they are likely to be used are of such varying types, shapes and sizes as they have been heretofore. Scarcely two reflector makers put out forms of reflectors that agree, consequently it has been practically impossible to foretell just what kind of light distribution was to be obtained unless one knew exactly what make and size of reflector was to be used. Naturally, this has acted as a handicap to the more general development of the lighting industry.

Fortunately, the disparity in the relative development of these two closely related lines became more and more obvious alike to the lamp and to the reflector manufacturers, and the need for war-time economy and efficiency have now brought them together with the agreeable result announced on another page of this issue of the development of a standard line of reflectors. At present this is confined to porcelain-enameled steel reflectors for direct lighting, but it is expected that the advantages resulting from this initial standardization will bring about similar development in other lines of reflectors. Certainly there is no reason why further standardization should not be attained because the requirements of reflectors are now well known and it is no advantage to have such a great variety of types and sizes.

Raising Capital in Dayton

CENTRAL-STATION managers will watch with considerable interest the efforts of the Dayton (Ohio) Power & Light Company to dispose of preferred stock to the amount of $91,000 to its customers. While the sale of utility securities to the patrons of a company is no longer an innovation, this is perhaps the first instance in which the sale of stock has been conducted on a campaign basis, just as flatirons would be featured in a special sale.

Even before the abnormal conditions made it difficult for central stations to secure new capital, utility companies gave consideration to the advisability of disposing of securities to their customers, realizing that such stock ownership not only afforded a ready means for obtaining capital, but by making customers financial partners in the utility enterprise fostered a spirit of good-will toward the company, which is so desirable, especially under present-day conditions.

In the Dayton instance the stock will be disposed of by the salesmen of the company and a partial payment plan has been adopted, providing an initial deposit of $15 and monthly payments of $10. The reason for making a campaign effort out of the sale was not to conflict with the forthcoming Liberty Loan campaign which will be started in September. It is expected that the entire allotment of $91,000 will be disposed of well before that date. The success of the Dayton plan will open up new channels to utility companies for raising money in a short period of time and if successful can be emulated by many companies hard-pressed for additional capital.

Fitting the Task to the Worker

MANY thousands will presently return from the war maimed and crippled, and in other ways incapacitated for the work they did before they gave their health and physical ability to their country. These men will have a right to expect work for which they are fitted, not as charity, or out of pity, or as patronage, but as their just right.

Congress has delegated to the Federal Board for Vocational Education the great task of re-educating and rehabilitating our wounded soldiers and sailors for civil life and usefulness to their country and themselves. The task is an important one, a large one, and one requiring care. According to available statistics, the number of men to be trained will approximate 10,000 per million men per annum. With our present military and naval strength, this means about 30,000 men will have to be re-educated this year. And as the country's strength increases, and as trench stalemate changes to more sanguinary fighting, the number will increase.

The experience of our allies shows that more than 80 per cent of men permanently disabled can be re-educated for self-sustaining, useful work. To make them fit to work and find them fitting work is our privilege and our obvious duty. Men who have jeopardized their lives and given their health for their country must not be given jobs out of suffrance, as old-age pensions charged to necessary expense. They must be given work where able to retain their self-respect, which means work for which they are fitted, work that keeps them satisfied and enables them to earn a respectable wage. The work must be such that their disability does not prevent their succeeding in their undertaking, and preferably such that their sacrifice for the national cause shall not hamper and handicap them in earning a living.

There are many jobs the central stations and the electrical industry in general have to offer our war-worn heroes. Meter repairing, testing and reading; station operating and load despatching; appliance repairs; winding of coils; and a vast number of other work, some quasi-technical, some purely mechanical, some merely supervisory. We hope the A. I. E. E., the N. E. L. A., the S. E. D., the Jovian Order and the various trade associations, manufacturers and labor organizations making up the electrical industry will do their utmost to find a place in this vast industry for those that risked their all and gave so much.

What is to be done for our maimed soldiers and sailors concerns us all—the man in the draft, every relative of a fighting man, every American. We must see to it that those who have risked their today shall not forfeit their future, due any fault of ours. Things electrical will be one of the major methods of making again the maimed and injured. But the electrical industry must do more—it must find work for the crippled and make possible for them work they could not do otherwise than electrically.

Week's Events

Electric Furnaces Needed for War Work—Reflectors Being Standardized—Rehabilitating Water Power in Minnesota

IMPORTANCE OF ELECTRIC FURNACES IN STEEL PRODUCTION EMPHASIZED.

Prominent Furnace Manufacturer Protests to War Industries Board Against Discouraging the Starting of New Electric Furnaces.

One of the most delicate and important problems of the war is the assignment of priorities in supply of raw materials and finished products, which involves the encouragement or discouragement of certain industries as dictated by the needs of the war. In the rush of the numerous war activities at Washington it is likely that insufficient consideration may be given to all the facts bearing on a particular industry so that harm may result not only to that industry but the production of necessary war supplies may actually be hampered. An instance of this kind is in connection with the manufacture of electric furnaces for use in the steel industry, and it is believed that publication of the following self-explanatory extracts from letters between a represntative of the War Industries Board and a prominent manufacturer of electric furnaces will help to show the importance and essential nature of these furnaces to the steel industry and therefore to the war.

The following is from a letter from H. C. DuBois, of the Chemical and Explosive Division of the War Industries Board, Washington, D. C., to the Booth-Hall Company, of Chicago:

"At the present time we are not encouraging, and, in fact, are discouraging anyone from starting any new furnaces on electric steel. The Steel Division informs us that their records show at the present time electric steel production is somewhat in excess of supply, and the electrode situation being so critical, we cannot encourage any further consumption of electrodes, where the product made by the use of such electrodes is not of vital importance."

The following is the reply by C. H. Booth, president of the Booth-Hall Company, dated July 31:

"We have a letter under date of July 12 from Mr. H. C. DuBois of the Chemical and Explosive Division, stating that you are taking steps to discourage the starting of new electric furnaces for the manufacture of steel. He informs us that your records show that at the present time the electric steel production is somewhat in excess of the demand.

"We wish to vigorously protest against any such action on your part. As a member of the American Iron and Steel Institute, the writer was present at the spring meeting in New York City, and heard Mr. J. L. Replogle make a public statement that the steel demands for building of ships, and the requirements of the Army and Navy were so great that it was very doubtful whether the entire steel production of the United States would be adequate to take care of the demand as fast as would be required. We cannot understand why conditions should have changed within the last 60 days to such an extent that you are warranted in discouraging the building of new steel capacity. The more electric furnaces placed in operation producing steel which can be turned out, either in the form of high-grade alloy and tool steels or high-grade steel castings, *the more will the open-hearth and Bessemer capacity be available for the manufacture of plates, structural steel and the other more common grades which are so much needed, and in the steel casting field will be released similar capacity for the manufacture of heavy castings where weight is the chief essential—or for the manufacture of ingots to be rolled into finished steel.*

"Frequent items in the daily and technical press show that the steel shortage feared by Mr. Replogle continues to exist, and that there has been no change in conditions within the last 60 days.

"We have every evidence to show that there is not enough electric steel melting capacity in the country to supply the present need for castings and high-grade steels. Electric furnace steel is getting the preference over other grades, and because there is not enough electric furnace capacity, the Government has revised its specifications for steel castings to allow for a higher percentage of sulphur and make practical the use of convertor and open-hearth steel for such purposes.

"The furnaces sold by this company have all been for Government work. The writer has just returned from a trip to the plant of the West Michigan Steel Foundry Company, Muskegon, Mich., where one of our three-ton units has just been placed in operation. For many weeks the Navy Department has co-operated with us in every way to hasten the time when this furnace could be started, as castings were badly needed and they wished them made of electric steel. They are now impatient to have this furnace run 24 hours per day, and could place other contracts with the same foundry if they had the electric furnace capacity.

"This general condition exists with the furnaces we have at Peoria, Ill.; Dayton, Ohio; Monroe and Detroit, Mich.; Chicago, Ill.; Springfield, Mass., etc.

"The fact that a large number of companies have solicited contracts at Washington which would require electric steel for castings or special steels, may have given the impression that there was a considerable surplus electric furnace capacity. We are confident that, if careful investigation were made, it would disclose a large percentage of these companies have not as yet purchased their electric furnace equipment but expect to do so as soon as they secure the necessary Government contracts. It is evident that this condition does not mean a surplus of actual electric furnace capacity but only indicates to what extent the electric furnace is recognized as the best method of making the high-grade steel castings and the other special grades of steel required for Government purposes.

"The electric furnace today is admitted to be the best method of making quality steel. In the steel casting field it has eliminated the crucible, and is rapidly replacing the convertor. The open-hearth furnace for castings is practically restricted to the heavy casting

field where weight is the chief requisite. For the manufacture of alloy and tool steels, the adoption of the electric furnace has been rapid, until today the better grades of these steels are all made in the electric furnace. The requirements of the Government for steels having special physical properties have been met because these could be made with the electric furnace.

"In the manufacture of malleable and gray iron, the electric furnace is already demonstrating the superior quality of metal which can be produced and it is being rapidly adopted for the melting of brass and non-ferrous metals.

"There is hardly a metallurgical field where the use of the electric furnace in some form is not being considered or developed.

"Mr. DuBois has suggested that there is liable to be a shortage of electrodes, and for that reason the installation of new electric furnace capacity should be held back. On the other hand, we wish to point out that if the use of electric furnaces is *encouraged;* and not discouraged, it will stimulate the electrode industry. Why not aid the present manufacturers of electrodes to increase their capacity, or encourage the formation of new companies? With Government aid, many problems much more complicated and technical than the manufacture of electrodes have been mastered and large outputs obtained. The manufacture of electrodes is quite simple by contrast and should be quickly and easily handled.

"There has been for some time a shortage of ferro-manganese, which is an absolute essential in the manufacture of steel. Has the Government discouraged the manufacture of steel because of this shortage? To the contrary, a careful study and investigation has been made to determine to what extent steel can be made using lower grades of manganese alloys and other substitutes.

"Your position in this matter is a vital one to us and to all other builders of electric furnaces, and for that matter to all manufacturers of electrical equipment used in the construction of electric furnaces. To have your Board take such action, in the face of the recognized position of the electric furnace and its great field of usefulness in connection with the manufacture of steel required for war materials, will be a severe setback to the development of the industry. If you continue to discourage the purchase of electric furnace equipment we should know so promptly, so we can take steps to adapt ourselves to such conditions."

STANDARDIZED STEEL REFLECTORS DEVELOPED FOR INDUSTRIAL LIGHTING.

R-L-M Standard Porcelain-Enameled Reflectors Brought Out Through Co-operation of Reflector and Lamp Manufacturers.

The Associated Manufacturers of Electrical Supplies, through their Reflector Committee, have been working for some months over the problem of setting and adopting standard dimensions and other specifications for porcelain-enameled steel reflectors.

The difficulties attendant on this work were many and, inasmuch as the physical properties of reflectors are directly dependent upon lamp dimensions, the development of standardized reflector designs was carried on by joint meetings of the committees of both the reflector manufacturers and the engineering departments of the various lamp companies. These joint meetings were the result of appreciation by the reflector manufacturers, not only of the great advantages to be derived by the purchaser of standardized reflectors, but also the benefits derived by the lamp manufacturers on account of their interest in securing the best type of reflectors for their lamps.

As a result of these meetings certain standard dimensions and specifications for dome reflectors were adopted by the reflector manufacturers. These manufacturers will, within a short time, place upon the market dome reflectors under the trade name or designation of R-L-M Standard, meaning "Reflector and Lamp Manufacturers' Standard."

Entering into the discussion was a question of the character of the porcelain-enamel surface. The outcome of this discussion was the adoption of a quality of enamel which is regarded as the most efficient for light purposes, considered from a standpoint of efficiency on the one hand and elasticity on the other.

The R-L-M Standard reflectors for the present will be confined to the dome types for direct lighting, and will be furnished in various sizes to receive lamps ranging from 75 to 1000 watts, inclusive.

The adoption of these R-L-M Standard reflectors marks but the first step in the development of reflectors by the committees. As conditions warrant, various other types of reflectors will be discussed, and certain standards adopted. As soon as the conclusions of the committees have reached a point where their findings are sufficiently exact to be adopted by the reflector manufacturers, and approved by the lamp manufacturers, such conclusions will be made public.

More detailed information concerning the R-L-M Standards will be published by the various reflector manufacturers individually through such channels as they themselves may select.

STRIKING EMPLOYES SHUT DOWN CENTRAL STATION SYSTEM.

Statement of Utility Company Showing Arbitrary Shutdown Without Notice or Rersponsibility.

During the last few weeks, an unprecedented state of affairs has arisen in Vancouver due to the action of the operators of this company's power plants and substations in wilfully attempting to close down all electrical supply as a means of enforcing their wage demands and other alleged grievances. The details of the actions which preceded the shutting off of power at midnight on Saturday, July 13, without notice being given to the company or the public warrant full disclosure as per the following statement of the utilities.

"The agreement between the British Columbia Electric Railway Company, the Western Power Company and the British Columbia Telephone Company respectively and the electrical workers expired on June 30. Previous to that the men laid a new agreement embodying many drastic increases and changes before these companies. An increase of 10 per cent offered by the two first named companies was refused. Accordingly a conciliation board under the Lemieux Act of Canada was proposed, but the men refused, thereby necessitating the Dominion government to name an arbitrator for them. The conciliation board was formed but the electrical workers refused to recognize it.

"Meanwhile, an arbitration with the street railway men employed by the British Columbia Electric Railway was going on. The men in both unions decided to go on strike at midnight, July 1, in contravention of the law of Canada.

"It is believed that the electrical workers fully

intended that Vancouver and the surrounding country should have been left without light or power on their going on strike, but this was prevented, except street car service.

"On July 11 about 1:10 o'clock, the agreements were signed between the company and the two unions. Service resumed the same day, with matters believed to be finally settled with the exception of one or two minor details such as free transportation and a lighting rate concession which had by consent been left to be adjusted later.

"After midnight on July 14, without warning, all lights, power, street cars and interurban cars fed by the British Columbia Electric system stopped. Hundreds of persons were abroad at this hour, street cars were loaded, and interurban cars were miles from their destinations. The effect of the stoppage of light and power in hospitals and cold storage plants need not be emphasized. It is evident, however, that the men intended to make the tie-up complete because not a switch was left in place in the main receiving station.

"All switches throughout the country were pulled, entailing a tremendous mechanical task to reinstate them.

"Attempt to arrive at the cause of the trouble, by communication with the business agent for the electrical workers, brought no coherent account. The union refused to meet the company in any way unless the electrical superintendent was discharged; also other unnamed officials would have to be discharged also.

"On Sunday, July 14, a committee of members of the board of trade and the mayor endeavored to bring about a settlement. Street cars were again tied up owing to scarcity of current and refusal of the men to work while the electrical workers were on strike. A joint committee was formed having on it several labor representatives and the company laid its case before them.

"Then men demanded transportation and lighting concessions and although we pointed out that these had never come up, we granted them forthwith. They alleged that 25 men had been dismissed in discriminating fashion and strike breakers kept on. The company showed that the men laid off were linemen and groundmen and were extra staff that had been working on special work which the company expected to lay off several weeks since on the completion of the work. These men were laid off strictly according to the length of their service and not a single non-union lineman or groundman was in the employ of the company.

"The men demanded the dismissal of the electrical superintendent. The company, however, agreed to place the case of the electrical superintendent up to arbitration while the electrical workers should go back.

"This solution was accepted by the joint executives of electrical workers and street railway men who promised to recommend it to their members. The street railway men met on Monday and car service was resumed the same afternoon. The electrical workers met on Monday night but refused to carry out the recommendations of their executive and demanded the dismissal of the superintendent immediately.

"The arbitrary attitude of the electrical workers is without precedent in this part of the country. We believe that they will be censured without exception for their deliberate attempt to tie-up the life of Vancouver and district when they shut down all electrical supply without warning or notice on the morning of July 14.

"This has ceased to be a matter between the British Columbia Electric Railway Company and the employes. It is a matter for the public to settle—whether they will allow any person or body of persons to close down such essential services as electric light and power without a moment's notice and without responsibility for the consequences."

PUBLICITY AND SALES PLANS OUTLINED BY SOCIETY FOR ELECTRICAL DEVELOPMENT.

How It Is Proposed to Save Food, Fuel, Time and Money By "Do-It-Electrically" Method.

The first gun in the campaign for war-time business, inaugurated by The Society for Electrical Development, is in the form of a superbly lithographed folder in six colors, telling how to save fuel, food, time and money "By Wire." The folder is 28 by 36 inches in size. It contains the frontispiece color design, illustrating the accomplishment of comfort, convenience, economy and efficiency by the "Do-It-Electrically" method. One of the things of primary importance in the proposed campaign is to outline and execute a plan of providing additional outlets in the thousands of places where they are needed to put in effect the greater use of electrical appliances in households. This subject was fully covered by the ELECTRICAL REVIEW in the issue of July 13, wherein it was shown that in putting through this campaign, the necessity for a greater number of outlets would redound to the benefit of the electrical contractor as well as to that of the dealer and central station.

The co-operation proposed by The Society for Electrical Development involves many features of publicity and sales promotion, all of which is graphically set forth in the society's poster and other literature.

35,000-KILOWATT TURBINE EXPLODES.

Machine in Commonwealth Edison Company's Northwest Station Wrecks Self.

Early on the morning of July 31 a big turbine at the Northwest station of Commonwealth Edison Company, Chicago, exploded. The rotor flew to pieces, shattering the turbine case and damaging the power house walls. The damage from demolishing the machine is estimated by W. L. Abbott, chief operating engineer of the company, as about $100,000. No fatalities nor injuries were incurred and service was uninterrupted.

The turbine that wrecked itself was a 35,000-kw., 1500-r.p.m. unit of the impulse type, the wheels being arranged in a single casing, increasing in diameter progressively from first to last stage, and the length of blading increasing in accordance with the volume of steam in its expansion through the turbine. The generator was wound for 25 cycles, 9000 volts, three-phase. A single-balanced spring-closed valve, controlled by the governor through a cam-actuated lever, controls the steam entering the first-stage nozzles. Control of steam to one of the intermediate stages of the turbine is accomplished by a valve of similar design, which automatically opens when the load on the unit attains a predetermined value. By this arrangement it had been aimed to eliminate the numerous valve admissions of previous designs.

At present little is known as to the exact cause of the accident and the extent of the damage has not been given out. The unit had been taken off the load at

about midnight, preparatory to being shut down. It was still being supplied with steam when it commenced to vibrate, becoming worse rapidly. The attendant made effort to shut off steam, but before being able to do so the rotor exploded, debris was thrown through the turbine case and hurled over the station and through the walls.

What caused the vibration, resulting in the accident, why the throttle valve controlling steam supply did not act in time, what was the vacuum carried by the machine previous to and at the time of the accident, the extent and seat of damage are not known. It is fortunate the generator was disconnected from the bus, otherwise the generator might have been destroyed.

ENLARGING AND IMPROVING WATER-POWER PLANTS ABOUT MINNESOTA.

Rehabilitation and Extension of Plants Permits Attaining Higher Efficiency and Greater Output, Thus Helping Relieve Fuel Situation.

The Power Engineering Company, Minneapolis, which makes a specialty of designing water-power plants and supervising their construction, reports considerable activity in Minnesota and adjoining states in that line of work. The projects are not large, but in most cases they consist of additions and changes that require a considerable amount of new equipment.

A good many changes relate to flour mill power. For instance, a mill, which is operated by water power direct, is so enlarged in capacity as to require more power. This situation is met by either installing a hydroelectric generating plant, or buying central-station service, leaving the original water-power installation intact. At all events, the larger capacity requires motor drive. Among the new plants that may be mentioned there are both private and municipal projects.

A hydroelectric plant designed for the municipality of Broadhead, Wis., now under construction, comprises a 165-kv.a. unit, consisting of a Morgan-Smith water wheel and an Electric Machinery Company generator. In addition to this, an auxiliary steam-electric plant of 150-kv.a. capacity is being built. The work involved the building of one mile of concrete-lined canal from the old dam to the plant, and the construction of concrete draft tubes for leading the water to the wheel. This development is on the Sugar River.

At Lanesboro, Minn., an old masonry dam is being utilized in connection with the construction of a new hydroelectric plant for the city, to operate under a 28-foot head. A high-efficiency water wheel, made by the Hydraulic Turbine Company, Camden, N. Y., a 13-ft. steel draft tube, a 150-kv.a. generator, and a Westinghouse switchboard are being installed. The water is conducted from the forebay at the dam through a concrete flume to the steel penstock.

Another piece of work in progress is for the Great Northern Flouring Mill Company at St. Cloud, Minn. This is a case of remodeling and re-equipping for greater water-power efficiency, where no electric power is used. The water wheel is being reset, and a 400-ft. rope drive is being installed to connect the water wheel with the main drive shaft in the mill. The wheel is driven under a 16-ft. head, through a steel penstock, 10 ft. in diameter.

The Greene Electric Light & Power Company, Greene, Iowa, is having a 30-kw. addition made to its existing 100-kw. plant, producing direct current. The additional equipment will consist of a high-speed, horizontal wheel and a 30-kw., 110-volt, compound-wound, direct-current generator. The additional energy is intended to take the light load between midnight and 5 a. m.. This plant is on Marble Rock River.

The Geo. A. Hormel Company, Austin, Minn., which built a new flouring mill of 600 barrels capacity, installed two new water wheels to enable it to use the available water power more advantageously, and also to operate a generator. In addition to the electrical energy produced in the plant, the company buys power from the local central station.

A new water-power plant, designed by the Power Engineering Company, recently was completed for the L. G. Campbell Milling Company, Northfield, Minn. A concrete dam, 175 ft. long, was built, producing a 10-ft. head, and new water wheels were installed, to operate a part of the mill machinery by water power direct. Additional power required is supplied by the Northern States Power Company's electric plant.

ELECTRICAL EXPORTS FOR MAY WERE QUITE SATISFACTORY.

Continued satisfactory condition is shown by the electrical export figures for the month of May that have just been made public in the monthly summary of the foreign commerce of the United States issued by the Bureau of Foreign and Domestic Commerce, Washington, D. C. A total of over $5,013,000 in electrical shipments is reported, which is nearly 10 per cent greater than May of 1917. This value is also considerably higher than the average of the eleven months of the present fiscal year which began July, 1917; for this period the report gives $49,507,951.

The detailed figures for last May and for the corresponding month a year ago are given below:

Articles.	May, 1918.	May, 1917.
Batteries	$ 308,895	$ 204,526
Carbons*	112,903	.....
Dynamos or generators	443,331	235,768
Fans	120,930	66,604
Heating and cooking apparatus*	48,492	.....
Insulated wire and cables	344,186	628,384
Interior wiring supplies, including fixtures.	140,050	121,928
Lamps—		
Arc	1,085	1,643
Carbon-filament	10,459	15,356
Metal-filament	309,413	346,037
Magnetos, spark plugs, etc.*	160,395	.....
Meters and measuring instruments	161,431	84,294
Motors	574,437	427,224
Rheostats and controllers*	28,516	.....
Switches and accessories*	148,359	.....
Telegraph apparatus, including wireless..	32,339	101,940
Telephones	251,785	156,917
Transformers	214,958	151,766
All other	1,601,415	2,047,888
Total	$5,013,379	$4,590,275

*Not separately listed prior to July 1, 1917.

MICHIGAN SECTION, N. E. L. A., PLANNING WAR-TIME CONVENTION.

The Michigan Section of the National Electric Light Association will hold its annual convention on September 17 and 18 at the Pantlind Hotel, Grand Rapids, Mich. The program will be given over entirely to subjects of war-time interest. All technical discussion will be avoided that does not point directly to "Winning the War."

Capt. Thos. Chandler, of Sault Ste. Marie, president of the Michigan Section is now in France serving his country, so the meetings will be conducted by Vice-President W. M. Lewis, of Muskegon. Speakers of note have been secured and it is expected that the program will be a very interesting and beneficial one. H. Silvester, of Monroe, Mich., is secretary-treasurer of the section.

Commercial

Electric Furnaces Useful in War Plant—Billing Methods by Central Stations—Economy of Electric Industrial Heat

HIGH RECORD MADE BY NEW ELECTRIC BRASS FURNACE.

Reports of Power and Light Sales by Louisville Gas & Electric Company.

The commercial department of the Louisville Gas & Electric Company, Louisville, Ky., in a recent review of new installations for which electric power is being supplied, reports that The Standard Sanitary Manufacturing Company has placed in operation the first of five electric brass furnaces which it proposes to install. The first week's run of the new furnace, according to report, showed that metal losses can be reduced to less than one per cent. The record of this work is, of course, gratifying to the company and will remove any hesitation that may have existed about installing the other four furnaces.

As regards power and light sales of the Louisville Gas & Electric, for the week ended July 13, the commercial department states that 64 new electric light and power customers were secured, requiring 46 kilowatts for lighting and 99 horsepower for motors. Another item of interest reported is that the Lexington Street Brewing Company is making plans to adapt its plant to the making of soft drinks, and for this purpose has installed equipment for using electric power, replacing one of its engines.

INCREASED POWER FACILITIES FOR MINNEAPOLIS.

Growth of Load Necessitates Installation of Big Turbo Unit in Steam Plant Auxiliary to Eight Hydroelectric Plants.

The Minneapolis General Electric Company, whose power-producing facilities are loaded to about capacity, ordered some time ago a 45,000-horsepower steam turbogenerator unit for installation in its Minneapolis auxiliary plant. The company hopes to get delivery on this in October, and probably would be able to get it installed and ready for service in five to six weeks thereafter. This will materially relieve the pressure for additional power service.

This organization operates eight hydroelectric plants in the district about the Twin Cities. One of these is 115 miles and another is 60 miles from Minneapolis; the other six are at nearby points. There are other water-power sites in Minnesota on which the company would develop hydroelectric energy if conditions were more favorable.

The company's flour-mill load in this vicinity amounts to about 2500 horsepower, and other flour mills are being electrified. In two of the Minneapolis breweries changes are being made to adapt the equipment to electric drive, in anticipation of restrictions and priorities that may be imposed by the Fuel Administration. In this connection the matter of electric heat is also being considered.

ELECTRIC FURNACES IN STEEL PLANT AT TORONTO.

Government Installation Demonstrates Value of Electric Furnaces—Purchased Power Used.

The plant of ten Heroult electric furnaces built at Toronto, Canada, early in 1917, constitutes an important factor in war work carried on there under direction of the British Government. Its construction was authorized in January, 1917, and work began February 1. The first steel furnace was ready and in operation by June 16, and the entire battery of ten furnaces were ready for service by August 11, 1917. This was all accomplished considerably in advance of schedule time, in the face of many attendant difficulties.

General direction of plans were in charge of Col. David Carnegie, ordnance adviser and member of the Imperial Munitions Board, with Perin & Marshall, New York City, as consulting engineers. This is an electrically-operated plant for steel making, in which the large accumulations of steel turnings at many munitions plants are being used. It was built for British Forgings, Ltd., a holding company of Toronto.

In pushing through this work to completion, there was secured the active co-operation of Roger Miller & Sons, Ltd., Toronto, the Toronto Harbor Commissioners, and the Hydro Electric Power Commission of Ontario. The site is on reclaimed overflow land, on Ashbridges Bay, Lake Ontario, made available by hydraulic sand filling. Other industrial plants are situated in that locality. In order to secure a satisfactory foundation for the building, furnaces and machinery, it was necessary to drive 1500 wooden piles through the strata of sand and muck that overlaid the gravel bedding.

The building, which is of steel, is 610 feet long, the space for the furnaces and castings pit having a span of 75 feet, with an additional width of 25 feet for transformers and stock bins; besides, there is a runway for yard stock the full length of the building and 75 feet wide.

The most interesting feature is the array of six-ton furnaces, each equipped with tilting mechanism. The furnaces rest upon a reinforced concrete charging floor 12 feet above the casting floor. The tilting devices, situated directly under the furnace, are the standard Heroult type, so constructed that a steel, brick-lined pan below the furnace shell, sloped toward the ladle pit, will protect the tilting mechanism from contact with metal that might break through the furnace. There is an opening in the charging floor, in front of each furnace, to give room to swing the ladle which is covered by a removable plate during the melting process.

Energy From Central Power Stations.

For these furnace operations the Hydro Electric Power Commission, of Ontario, supplies alternating

current energy at 13,200 volts, three-phase, 60 cycle, from one of its stations at Niagara Falls. The primary current passes through 13,200-volt electrolytic lightning arresters, 30,000-volt oil circuit breakers, to 1500-kilovolt-ampere water-cooled transformers. There is one transformer to each furnace, by which the furnace is supplied energy at 100 volts through delta-connected secondary bus-bars and 18 flexible cables of 2,000,000 circular mil. Each furnace is equipped with three electrodes, 17 inches diameter.

Other features of the furnace equipment consist of Thury regulators, situated in the transformer room; and a furnace-control switchboard, in the rear of each furnace, which carries the ammeters and winch-operating controllers for raising and lowering the electrodes.

The transformer room has a central bay which is so arranged as to afford a clear view of the furnaces. The switchboards for the control and service switches, recording and indicating meters are contained in this room. There are three 300-kilovolt-ampere service transformers in this room.

The general service equipment, located on the casting-floor level, consists of a 60-cell storage battery; two motor-generator sets, 250 and 300-kilowatts, respectively, for 230 volts, direct current; an air compressor of 250 cubic feet capacity; oil pumps and repair shops.

The scrap storage yard, 610 feet long, with capacity for 12,000 tons, is served by two 10-ton traveling cranes of 75-foot spans, each one having a 55-inch lifting magnet. Material from the storage yard is hauled to the furnaces in 24-inch gauge scrap cars, which pass from weighing scales to positions between furnaces, where the scrap is dumped and hand-charged to the furnaces.

There is a system of storage bins on the casting floor level for refractory material received from the United States, this material being delivered to points beneath the hatches in the charging floor by means of cars running on a narrow-gauge track that serves the system of storage bins. An electric hoist operating on an overhead mono-rail that extends the full length of the transformer floor serves to handle stock from the general storage bins to the charging floor.

Other equipment comprises a physical laboratory, two 200-pound motor-driven test-hammers, a grinding pan and miscellaneous utilities.

At this plant 12-inch ingots and 6-inch shells are being made, for turning into munitions in the Dominion.

BILLING FOR GAS AND ELECTRICITY ON ONE BILL.

The Public Service Company of Northern Illinois has recently adopted a policy regarding billing for gas and electric light and power in keeping with general economy. Whereas it has been the custom to bill customers using both gas and electric light with a separate bill for gas and a separate bill for electricity in the same envelope, the company has now adopted one form of bill for both. This bill is suitable for billing a customer for his gas, electric light and power, there being portions of the bill apportioned for each of the three. This is a practice that has been followed for a long time by many companies, while many more have adopted it during the last year and one-half, as a means of economizing stationery and labor. The Public Service Company sends out most of its bills by boys.

DUPLICATE FORM OF POWER AND LIGHT BILL.

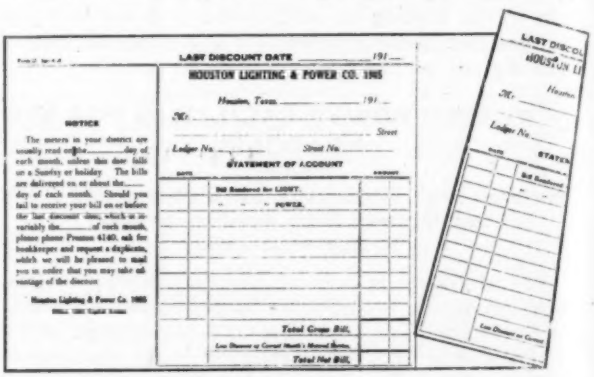
Houston Light & Power Company Adopts Time and Labor-Saving Form of Bill.

The Houston Lighting & Power Company, Houston, Texas, has recently adopted a new form of bill. As shown in the accompanying illustration this provides space for the statement of account, a notice to the consumer and a duplicate bill, all in one sheet. The duplicate bill folds over so that the customer receives a carbon copy and the original is held in the office, a desirable feature in view of the large number of requests received each month for duplicate bills.

It was felt that if the customer could be kept advised as to when to expect the meter reader and the date on which his bill may be paid in order to secure the discount, the amount of labor involved in handling consumer accounts could be relieved considerably.

This has been accomplished. This form also automatically provides a duplicate bill which can be held in the office, ready when the consumer calls and says the bill has been mislaid or not received.

It has been the experience of the Houston Lighting & Power Company that about 90 per cent of the customers who apply for duplicate bills, have either misplaced their bills or failed to bring them along. As a check on the bill deliveries, however, the bookkeeper asks each customer if he receives his bills regularly, and all cases where trouble is reported, are investigated. Very frequently the customer knows the amount of his bill and all he wants is a receipt for the amount and the last date of reading. Under the present system this is now ready for him. As a rule the customer is not interested in the actual figures of the meter reading and therefore, this information has been left off of the new Houston bill.



New Form of Duplicate Bill With Interesting Features Adopted by Houston Lighting & Power Company.

By the use of an indelible pencil the bill need only be filled out once and the form provides itemized information so that it is not necessary to again refer to the ledgers in case of inquiry and the customer is advised definitely as to the date of meter reading and the discount day.

NEW BUSINESS AT OKLAHOMA CITY.

During the month of June the Oklahoma Gas & Electric Company, in conjunction with the dealers at Oklahoma City, Okla., sold 804 electrical appliances, including 117 flatirons, 357 fans, 241 vacuum cleaners and 89 other household devices. There was a net gain in connected load during the month of 298 horsepower and 27 already built houses were wired.

LOW COST OF ELECTRIC HEAT SHOWN.

Comparisons With Cost of Other Energy Must Be Made On Basis of Results.

Much has been said regarding the high cost of heat—that it is much more expensive than the various forms of fuel. This is true when viewed from a B. t. u. basis only. The crux of the whole matter, however, lies in the fact that the cost of heat energy alone as compared with the entire cost of the finished product is in many instances neglible. Many items enter into the total cost of production, of which heat energy is only one, so that while electric heat may be more expensive, still, if by its use the other items (such as time required, labor, fire insurance, etc.) are cut in greater proportion, producing greater quantity as well as improved quality, it is evident that not only is electrically generated heat cheaper to use but also its use is imperative in order to compete successfully with those using it in similar processes.

Probably no more striking and forcible example of the saving both in time and money effected by the use of electric heat can be found than in the case of the repairing the interned German ships. Although there was a total of 109 ships damaged, which, if new cylinders and parts had had to be supplied, would have taken from 18 months to 2 years to repair, by the use of electric welding, all these ships were in service in less than eight months. The estimated cost of repairs on the first ships amounted to $32,000, and the time required 10 to 12 months for completion. By means of electric welding the work was completed in 52 hours at a cost of less than $2000 for the actual work done. Moreover, the cylinders withstood a test of over 50 per cent in excess of their normal working pressure, although it is only customary to test them up to an excess pressure of 20 per cent.

In many cases an electrode high in manganese was used which in itself supplied the proper tensile strength to the weld. Thus repairs were easily made in places which would have been extremely difficult if not entirely inaccessible, had a method of welding which required a flux been employed.

Another case in point is the manufacture of the all-metal automobile bodies by means of spot and arc welding. Indeed, were it not for the ease and rapidity with which welds are thus made, together with the strength obtained, many manufacturing processes, which involve a complete and oil-tight junction of metals would be commercially impossible—the stock being too light and thin to permit of riveting successfully. In manufacturing small articles like window sash pulleys, as is done at the American Pulley Company, Philadelphia, by spot and projection welding, many thousand welds are made per hour—in fact, just as fast as the operator can press a lever and demonstrates in a most striking manner both the flexibility and ease of control of the electric welder. Ship plates are pinned to the frames of the vessel by spot welding and later on arc welded along the edges, practically fusing the plates into one another. In both of these applications heat is developed at the exact spot, to the exact degree and for the exact length of time, only to effect a perfect junction of the metal. Where can you find a fuel-fired process so simple, so complete and so efficient in utilization of heat?

The practice of heating by induction is rapidly coming into use. In this case the material to be heated forms the short-circuited secondary of the transformer by which it is enclosed. While this method of heating is probably the most efficient of all now in commercial use, in its practical application it can only be used in connection with materials of uniform cross sections, because with an uneven cross section part of the piece may become superheated or even burned before the other part attains the desired temperature.

AUTOMOBILE TOURISTS USE ELECTRIC STOVES.

One feature about Denver that appeals to many visitors is the Tourist Automobile Camp at Rocky Mountain Lake Park, which, as the name indicates, enables traveling motorists to rough it in comparative comfort and with undoubted economy. The Denver Gas & Electric Light Company discovered a new revenue-producing source in this camp and installed five Westinghouse electric stoves, together with prepay coin-slot meters. The custodian sold more than 200 of the five-cent slugs in the first few days. Each stove user gets a meter consumption of 625 watt-hours for a slug, which means the city of Denver is getting eight cents a kilowatt-hour. The city pays the company four cents, less the discount, on a big power meter, so the coin meters are simply checks belonging to the city. Both stoves and meters were sold to the city, and it is expected that forty or fifty additional stoves will be sold before the end of the season.

2150 HORSEPOWER ADDED AT FT. SMITH.

The Fort Smith Light & Traction Company, Fort Smith, Ark., is negotiating with the Coal District Power Company for the complete electrification of the Central Coal & Coke Company's Hartford and Huntington mines, and has already secured contract with the Coal District Power Company for 500 additional horsepower for small mines, making a total of 1900 horsepower to be connected within the next 90 days. The company is also negotiating for the complete electrification of the Best-Clymer Company's plant at South Fort Smith, recently sold to the Burdett Oxygen Company. This will mean an addition of 250 horsepower to the present load of 250.

CHANGES IN OREGON COMPANY.

Four changes have been made in resident managers for the Oregon Power Company in the Willamette Valley cities and which have been announced by Elmer Dover of Tacoma, president of the Mountain States Power Company, which owns the Oregon Power Company. J. L. White, who has been manager at Albany, has resigned his position and will engage in business for himself in Seattle. He will be succeeded by C. U. Steelquist, who has been manager at Dallas. H. A. Joslin, manager at Eugene, will be transferred to Dallas. Fred Brown, an employe from the Tacoma office, will take over the supervision of the Eugene business.

ELECTRIC FURNACES IN ITALY.

According to "La Metallurgia Italiana," at the end of 1917 there were in active operation in Italy the following number and types of electric furnaces: Angelini 22, Ansaldo 1, Bassanesi and Stassano-Bassanesi 40, Catani 2, Girod 4, Heroult 14, Keller 10, Kjelling 1, Iloa 3, Sopranzi 1, Stassano 26, Tofani 5, of types not named 58, or 187 furnaces in all. Some of these have a capacity of 8 to 15 tons, many are of 3 to 5 tons, but the average is between 1 and 2 tons.

Operating

Interesting Method of Moving Linemen's Tools Along Railroad—Novel Metering by Combining Different Meters

PORTABLE TRACK LINEMEN'S TOOL KIT.

The accompanying illustrations show a portable tool kit on wheels that has been used on the tracks of the Western Ohio Electric Railway Company. The transmission parallels the trolley track, hence patrolling the transmission line is particularly adapted to inspection from trolley cars or by walking along the track. Likewise, when repairs or changes have to be made the track is used in various ways, as for delivery of material and men, storage of equipment along the side of the track, etc.

Crossarms, insulators and pins are changed whilst the transmission line is alive, a common practice with the medium potentials, but one requiring the employment of rather bulky equipment. The tool kit shown is used for containing these tools and keeping them ready and in proper condition for use. There is also room for the usual linesmen's paraphernalia. The tool kit is sufficiently long to hold a crossarm if necessary, as for easy movement with the tools.

The tool box is made up of sheet steel, the pieces being riveted together. The entire kit is sufficiently heavy to make it desirable to reduce lifting as much as possible on the score of fatigue as well as loss of time. On the other hand, the weight of the kit with its complement of tools is such that the outfit may be easily lifted off a car and placed on the track by two men.

Fig. 1.—View of Portable Tool Kit on Track.

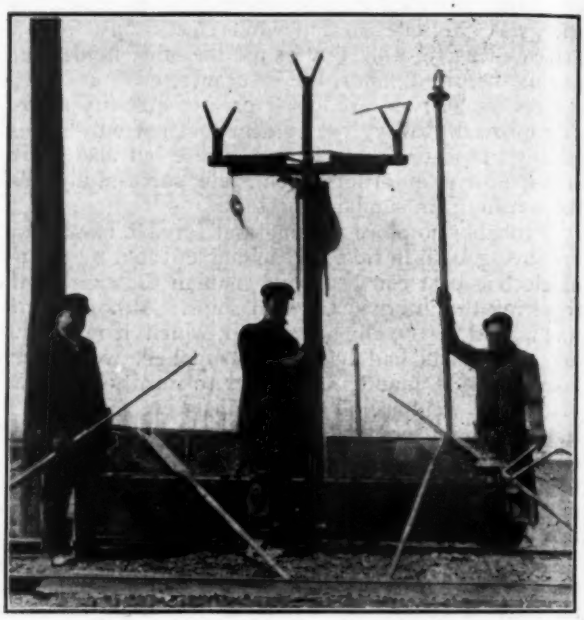


Fig. 2.—Close-Up View of Tool Kit, Indicating Relative Size.

Two small wheels are furnished to permit the box to be pushed along the rail from pole to pole as the work progresses. Four steel feet may be let down, two on each side, so as to rest on the ties, and thus prevent the box from tipping over to either side. In instances where a velocipede is used, it would be a simple matter to hitch up an additional wheel by means of stay rods for the far rail, and in this way haul the tool kit along.

The tools for use on hot conductors may be closed up and placed in the kit box and readily moved, at the same time being kept together in good and dry condition. That the tools are all together eliminates the frequent incentive to "take a chance," reduces likelihood of property being lost or left behind, and effects a saving of time.

NOVEL METERING INSTALLATION.

Combination of Meters by Rochester Railway & Light Company Effects Economies and Conveniences.

Metering the Rochester & Lake Ontario Company's service presented an unusual problem to the Rochester Railway & Light Company, says Frank C. French in the company's organ. Power is delivered at 11,000 volts, then stepped down to 380 volts for synchronous converters and also for 380-volt alternating current motors. It was undesirable to have a separate converter for railway work, therefore it was necessary to install a "dead head" meter and a demand meter.

A railway load is a difficult one to measure for demand and for this purpose it was determined to use

a Westinghouse type RA demand watthour meter, and, although an alternating-current meter, adapt it to work with a direct-current, watthour meter.

The Westinghouse type RA demand watthour meter consists of a regular type C polyphase integrating meter, clock and paper-driving device mounted on one base, as shown in Fig. 1. The regular register has two extra shafts, one fastened to an arm carrying a pen, the other shaft is mounted on a hinged bearing so it may be disengaged from the main gear train to allow the pen to return to zero. The shafts are connected to the gear train so that with full load on the meter the pen will travel three quarters of full scale of the chart in 15 or 30 minutes, depending on the time interval used. The clock is a 15-day, hand-wound marine type, having two very strong springs, one to drive the timing gears and one to drive the paper drum and pen resetting wheel.

On a shaft which revolves once in 15 minutes is placed a cam disengaging lever which allows the paper driving train to revolve, the paper advancing one-eighth of an inch at the end of each interval. This shaft also revolves a wheel in which there are four screw holes. If the time interval is to be 30 minutes two screws are placed in the wheel diametrically opposite, causing the pen to return to zero every 30 minutes. If the interval is to be 15 minutes, four screws are used and pen returns to zero every 15 minutes.

The meter used on the original installation is the General Electric astatic type. As the construction makes it impossible to place the demand meter in the same case with the watthour meter, a base was made and mounted above the watthour meter and fastened to its base. On this base was mounted the clock, paper-driving element and pen shaft support, as shown in Fig. 2.

The Westinghouse gear train was used and as the two manufacturers use different systems of connecting the gear train to the meter shaft and as the speed also differs, it was necessary to place a spur gear on the armature shaft in place of the worm, and to interpose a gear ratio of two to one in the register. After this had been completed and mounted in place, another problem was to connect the gear train and pen shaft, as they were some distance apart and not in the same

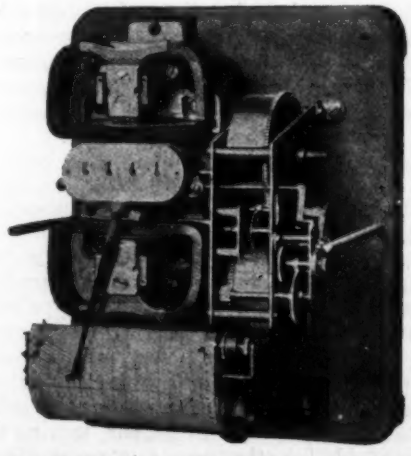


Fig. 1.—Westinghouse Type RA Demand Meter With Cover Removed.

line, and it was important not to add any appreciable friction.

This was accomplished by placing a small aluminum drum on the shaft in the gear train and one of the same size on the pen shaft, also fastening to and passing over these drums a small chain known to the watchmaker as a fusee. This worked very satisfactorily. The pen is reset by a perpendicular rod with two horizontal arms, one engaging with a lever on the clock, the other with the gear train.

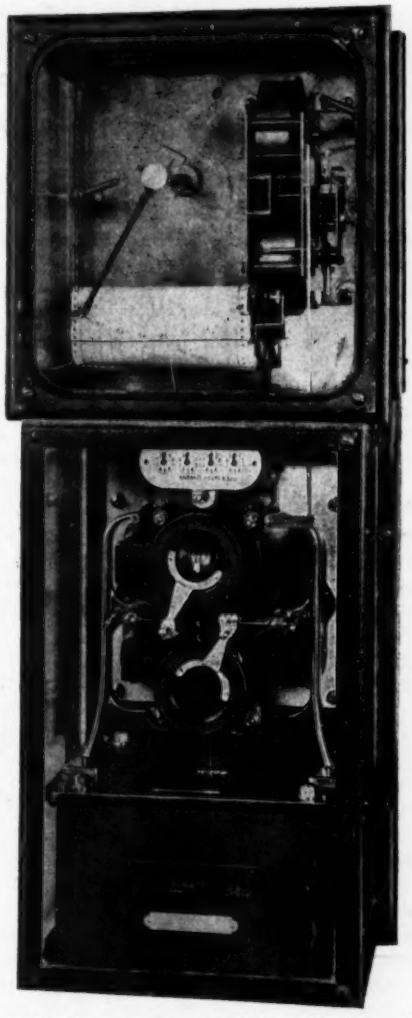


Fig. 2.—Combination of General Electric Watthour Meter and Westinghouse Type RA Demand Meter.

After this installation was complete a regular type R. A. watthour demand meter was installed on the total 11,000-volt load, thus giving two demand charts of the same kind, making it easier to compute the bills.

The illustrations show the original General Electric astatic watthour meter, and the Westinghouse type RA demand meter, which were so successfully combined by the meter department of the Rochester Railway & Light Company.

PROTECTING USE OF RUBBER GLOVES.

The use of three pairs of gloves by linemen handling live wires has been advocated in some quarters. These gloves are of fabric, of rubber and of leather, respectively. The fabric glove prevents perspiration and the finger nails from injuring the rubber glove. The leather gauntlet put on outside the rubber glove tends to protect the rubber from mechanical injury, enables the wearer to grasp tools to better advantage, and keeps the hands warm in cold weather.

Contracting-Construction

Contractors Finding Profit in Handling Farm Plants—Co-Operation of Manufacturers and Contractors—Shop Kink

WHAT ABOUT FARM-LIGHTING PLANTS?

Opportunities for Profitable Business by the Contractor-Dealer.

By Swift Miller.

Manager, Electrical Department, Mayhew Company, Milwaukee, Wis.

One of the biggest things that has happened in the electrical industry in recent years has been the development of the farm-lighting-plant business. But even today when these outfits are being sold at the rate of about a 100,000 sets per year, the "electrical trade" knows comparatively little about it. The business has been developed right under the nose of the contractor-dealer, and he hardly knew it existed until inquiries began coming in from remote places for wiring materials and electrical devices that were formerly sold only in the larger cities and towns.

The electric farm-lighting plant is not new; in fact, it has been made in practically its present form for the last 20 years, including gasoline engine, electric generator, storage batteries, and switchboard. There have been only a few important changes to make it more commercial and more readily salable to the farm trade. The business has been brought to its present proportions by a few men of courage who recognized its possibilities and were willing to give it the same or even greater support than had been given to other electrical lines already well established.

This work was not done by electrical people. The organizations who manufactured and placed these products on the market were previously unknown in the electrical business and recruited their forces from other lines of endeavor. Their sales organizations were built up from other lines outside of the electrical industry.

So here we have an established electrical industry, amounting to upwards of $15,000,000 per year, developed entirely by people outside of the electrical trade and their product distributed widely throughout the country without the assistance of the electrical jobber, the electrical dealer, or the electrical contractor.

It begins to look as though the electrical trade had overlooked a mighty good opportunity, but, fortunately, there is a greater opportunity in this line now than ever before. Those who have been pioneers and who have done the real missionary work of putting this business on a substantial basis have simply opened a way for the electrical trade which should now embrace this opportunity to get into a business that promises to make the electrical industry greater than it has been in the past.

The Farmer Needs Electric Light and Power.

It goes without saying that within a reasonable number of years electric light will be as universally used in the country as in the city. There are, in fact, more advantages in its use in the country than in the city. The question of economy will probably not enter into the case any more than it has in connection with the use of electric lights in the cities where electricity still costs more than gas. But the help problem is so serious with the farmer that he is obliged to take advantage of every possible means of saving labor and one way that he can do this is by using electric current for various power purposes on the farm. This is a very important factor just now.

But the real force behind the strongly developed demand now existing for electric light in the country is the desire of the farmer to have all of the conveniences enjoyed by his friends in the city and his present prosperity enables him to buy any of these things that are obtainable in the market.

The possibilities of this business can best be realized when one considers that although it has already reached large proportions, the number of plants now being sold annually is just about equal to the number of new farms established in this country each year, so that the real market in this line has hardly been touched.

Selling Farm-Lighting Plants Not Difficult.

In selling lighting plants to farmers the pioneer stage has been passed and very little missionary work is necessary in order to interest them. Farm-lighting plants have been extensively advertised, and farmers generally appreciate that electric lighting in the country is a success. They all look upon electricity as something that they must have eventually, and it is merely a question of when they will buy their plant. The present prosperity of the farmers in this country and the prospect of further prosperous times makes the sale of lighting plants comparatively easy.

It must not be imagined, however, that the farm-lighting plant can be sold off the shelf like a fan motor or a flatiron. Those who are most successful in this business have salesmen devoting their entire attention to soliciting farm trade, but the sales are easily made and salesmen find it a profitable line to handle on a straight commission basis.

Types of Plants.

There are at the present time a number of lighting plants on the market that are commercially successful. These are of two main types, namely, the belted-type plant and the direct-connected unit. There has been a considerable demand for the belted type of lighting plant by reason of the fact that farmers generally have engines that are used for power purposes and which can readily be employed for running the lighting plant. With such installations it is customary to belt the generator to the flywheel of the engine, leaving the engine pulley available for other power purposes. Many of these plants are used in connection with pumps for furnishing the water supply for the house and farm buildings. In such cases the pump and lighting plant are usually allowed to remain connected to the engine. As the engine is run more frequently for pumping purposes than would be required for driving the generator

alone, the lighting plant with such installations requires practically no attention, the batteries receiving a partial charge every time the engine is run for pumping water.

The direct-connected lighting unit is fast becoming the more popular type of plant. It has the advantage of occupying less floor space and is much smoother running as it employs a throttle-governed engine especially designed for this service. Such plants are usually equipped with a means for starting by pressing a button or raising a small lever and some are provided with an automatic device for shutting down the engine when the batteries have become fully charged. Other plants are made full automatic so that the engine starts itself automatically when the batteries are in need of recharging.

As to the merits of the automatic features there is no question but that the full automatic plant is more desirable, assuming that the automatic devices can be relied upon to perform their functions without attention. It is necessarily true, however, that the use of automatic devices complicates the system and makes it more difficult to correct troubles which may develop. On general principles, the more simple you make a device for sale to a farmer the better satisfaction it is going to give in the long run, so that the manufacturers of the more popular lighting plants are taking a middle course in furnishing what is called a semi-automatic plant. Such a plant is provided with a means of starting by pressing a button or a small lever and shuts itself down automatically when the batteries are charged.

Operation and Care of Plants.

Generally speaking, lighting plants that have been sold for farm-home lighting have been very successful and have not given the trouble that might be expected in placing so complicated a piece of machinery in inexperienced hands. Many plants are sold by small concerns who make no pretense of having a service organization. Such plants are sent out accompanied by an instruction book with the aid of which the farmer as a rule has no difficulty in installing, operating and taking care of his plant. Some of the concerns furnishing the more complicated automatic plants have developed service organizations for taking care of minor troubles, repairs, etc. It is of interest to note in this connection that lighting-plant manufacturers have found that the farmers and people in the country who purchase lighting plants are better informed on mechanical and electrical matters than might be expected. This is due, no doubt, to their experience with automobiles and with other farm machinery.

That the electrical trade is fast waking up to the possibilities of the lighting-plant business has become very evident during the last year. Many electrical contractors who had developed an extensive business in the wiring of country houses are beginning to realize that the business could be made much more profitable by placing themselves in a position to not only do the wiring, but to furnish the lighting plant and fixtures as well.

It should not take very much imagination on the part of electrical contractors and dealers to see the possibility of this lighting-plant business. Many farmers who have installed small plants have discovered the convenience of using various electrical devices and the electrical contractor-dealer in the country is being called upon to furnish them. Not only this, but as the farmer increases his uses for electric current he finds his original plant too small and is soon making his plans to install a larger outfit. This has already resulted in a demand for farm-lighting plants of larger capacities and the lighting-plant manufacturers are meeting this with well designed direct-connected units of various sizes that can be used for both lighting and power purposes on the farm.

IMPORTANCE OF CO-OPERATION BETWEEN ELECTRICAL MANUFACTURER AND CONTRACTOR IS RECOGNIZED.

J. Nelson Shreve Gives Analysis of Their Relations and Points Out Basic Value of Cost Accounting.

That the spirit of co-operation should take the place of individualism in the relations between the electrical manufacturer and the contractor-dealer, and that efficient cost accounting should be the controlling factor in the industry were brought out by J. Nelson Shreve, president of Electric Cable Company, in a paper read at the recent convention of the New York Association of Electrical Contractors and Dealers at Saratoga Springs.

In this paper, Mr. Shreve's initial declaration, which follows, contains the basic ideas of his address:

"At times it seems as if the manufacturer's interest ended at his own shipping door. Nowadays, more and more, manufacturers are realizing that in the electrical business the retailer possesses even more power to make or mar the product of a manufacturer than in other lines of industry where less engineering is involved. Besides this consideration of the contractor's ability to assist in the engineering end we have a consideration of the fundamental economic principles of all business. Unless these are understood, and the industry based upon them, its foundation is of sand. In the past there have been too many sand foundations. It is true we are getting away from this period which was due largely to the fact that economic principles were regarded as purely academic. The idea of applying them to every day commercial life was thought Utopian. If they are sound they are practical, a truth which every business man must recognize. As a nation, we have in the past been handicapped in our industrial development by too much individualism, and too many laws supporting it. We are just entering the age which older nations entered years ago—the age of co-operation.

"Efficient co-operation is possible only when the functions of every factor in an industry are clearly understood, and their inter-relation honestly recognized by everyone in the industry, and when each is supported by all in the exercise of its proper functions. This is the only sound basis for practical co-operation and it seems to me no one has presented this so clearly as Mr. Goodwin."

In considering the manufacturer and consumer in the electrical industry, he reminded his audience that a sale was not completed until the manufactured product is in service, is paid for, and public approval is given. This approval may be deferred until after long, satisfactory service. He then took up the functions of the jobber as distributor, and the contractor upon which installation depends. Regarding the position of the manufacturer, he continues:

"The manufacturer must be conscious of his responsibility to the public if he would secure and hold its approval. It means that his goods must be of a quality that will insure efficient service. In establishing prices he must consider the following:

"What are the most economical units in which he can manufacture? What is a fair additional cost for disbursing them in quantities ordinarily used by the wholesale trade? What further costs are justified when distributing goods in quantities suitable for the retail trade?

"These are important considerations in cost accounting, and any manufacturer who ignores them is fooling himself as well as the public. Recognition by the manufacturer of the service function fulfilled by the electrical jobber and the electrical contractor takes the form of discount. Now, everyone, I believe, will agree that there are only two reasons for discount—quantity and service, either or both. A concern that claims maximum discounts from a manufacturer on any basis but that of quantity and service should not have the claim recognized. The fact that a concern is in the electrical jobbing or contracting business, or a member of an association, is not sufficient reason for according the recognition asked for. To do so would be unjust to those whose services entitle them to the maximum consideration. Manufacturers' selling schedules should be arranged on a basis of differentials which attract and encourage the wholesaler to buy in the most economical units, and the retailer, in turn, to buy so as to render maximum service to the manufacturer, the jobber and the consumer.

"Reputation, which forms the basis of business building, necessarily plays an important part. What encouragement is there for a manufacturer of high quality materials to give the maximum recognition to a jobber or retailer, whose policy is formed solely on price? Or to a contractor who sells his services not on the basis of quality but of cheapness? None, whatever. In the first instance, he is encouraging the inefficient distribution of his product; and in the second instance he is promoting a quality of work that may make it impossible for his goods to render the service they are capable of rendering. The result is loss of the public's approval.

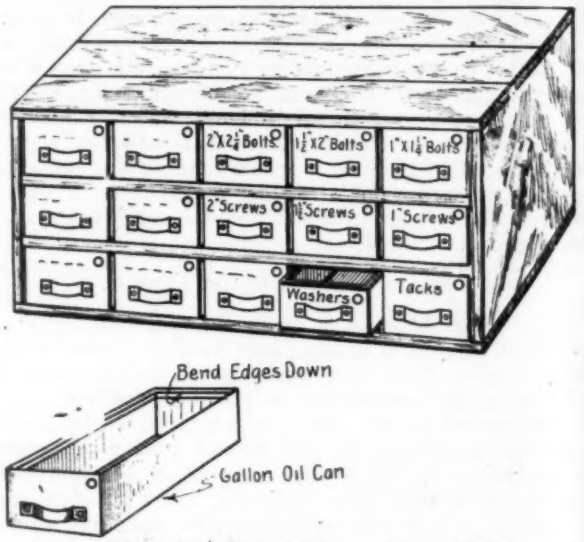
"The electrical industry is comparatively new, and one of its most serious faults is that it has not developed scientific merchandising to the same extent as have older industries. The subject is a large one and I shall refer only to one phase of it—cost accounting. Unless we have an accurate knowledge of costs, scientific merchandising is impossible. Inaccurate cost accounting is the real cause of most of the unfair competition that exists today. Let me illustrate what I mean by presenting a well-known condition in the electrical industry.

"There are concerns whose activities include two or more of the factors between the manufacturer and the ultimate consumer. A light and power company may act as a distributor of electrical equipment; a jobber may do contracting work, and a contractor may be a wholesaler and a retailer of electrical devices. Serious objection has been raised to this practice on the ground that it promotes unfair competition. There are many who believe that each factor should be confined to its special function. I do not agree with this point of view. It is not economical to attempt to build artificial barriers in the channel of distribution. Unfair competition does not arise because the concern is operating more than one branch of the industry, but because it is not scientifically merchandising its goods or its brains, and the reason for failure to do so is faulty cost accounting. Costs are averaged with the result that a profitable branch of the business is often made to carry an unprofitable one. The central station, for example, is not an undesirable factor in jobbing or contracting or retailing, provided it recognizes the factors of cost applying to these branches, thus preventing its main business from being used to create destructive competition in other lines of the trade in which specialist concerns depend for their entire living. Every branch of a business should be treated as a separate unit in the determining of costs and made to show a profit, otherwise it is working an injury to the trade as a whole from which it must itself suffer in time."

INEXPENSIVE SMALL-WARE CONTAINERS FOR THE SHOP.

By Thomas Johnson.

One gallon-oil cans of the standard shape shown in the accompanying illustration are very handy for making small-ware containers. All that is necessary is to cut open the wide side, as indicated, leaving a small amount of it to turn or bend down at the edges to reinforce it. A small packing box fitted up with a few board shelves completes the container. The cans have good handles and the whole outfit can be put together quickly and cheaply. It makes a useful container for the electrician's or contractor's shop, providing a place to put small screws, bolts, etc., that so easily are misplaced or mixed up indiscriminately.



Container for Small Stuff, Made of a Box and Oil Cans.

AMONG THE CONTRACTORS.

The F. E. Newberry Electric Company's Los Angeles office has been awarded a contract for electrical work in connection with the erection of a new five-story and basement structure on Broadway, between Sixth and Seventh streets, Los Angeles, Cal.

The Sterling Electric Company, Minneapolis, Minn., has under contract the wiring and all other electrical installations in the high school building at Virginia, Minn. The building is of steel and reinforced concrete, and will contain motors and other equipment for use in the industrial department, including wireless telegraph and telephone equipment. This company also has in hand all the electrical work on the new Y. M. C. A. building being erected in Minneapolis. This structure will represent an expenditure of about $700,000, the electrical contract alone amounting to $35,000.

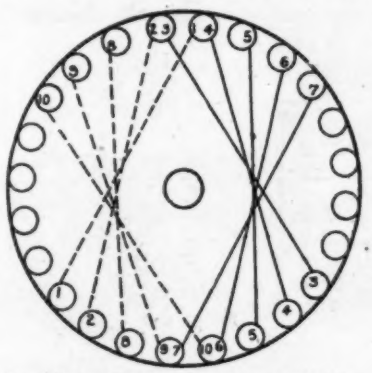
QUESTIONS AND ANSWERS

All readers are invited to submit questions and answers to this department. Anonymous communications will not be considered. Questions should relate to electrical matters of any kind. Answers contributed by readers should be submitted preferably within eight days of the date of publication of the question and should be limited, if possible, to 300 words. Payment will be made for all answers published.

Questions.

No. 433.—Motor Bearings.—What grade of babbitt metal is best for use in the bearings of 50, 75 and 100-horsepower induction motors operating at 720 revolutins per minute? A chain drive is used and of necessity very little slack is allowed. Also what is the difference between the inside diameter of an assembled bearing and the outside diameter of the shaft of the motor the bearing is used with?—W. B., Mt. Union, Pa.

No. 434.—Armature Winding.—I am winding an armature with 24 slots and 72 segments. The accompanying sketch shows the back of the armature with the first 10 coils in



No. 434.—Snag in Armature Winding.

place. There are 3 loops in each coil and 5 coils in series and 10 slots apart. I would like to know just where the rest of the coils are to go. The machine is a 35-volt, 12-ampere generator.—M. B., DeKalb, Ill.

No. 435.—Signal Lights on Shipboard.—Where the red and green running lights and the foremast light on a ship are electric lights, what arrangement is made to insure that no lamps have been burned out?—T. A. M., Racine, Wis.

No. 436.—Lighting from Three-Phase Service.—In a large factory plant the lighting and power is now supplied as 60-cycle, three-phase, 220-volt current from the central-station lines, the old factory plant having been shut down. At present the light circuits are supplied through a motor-generator set and are all wired as two-wire 110-volt circuits. The direct-current generator of this set has given some trouble and it is desired to operate the lights direct from the power supply. The inspector of the power company claims that it will be necessary to install three single-phase transformers and divide the lighting load evenly among the phases. This will require much rearrangement of the lighting circuits and to avoid this it is desired to find some way of placing the load on one phase or at most on two phases. The total connected motor load is about 160 horsepower. The lighting load connected amounts to a little above 25 kilowatts. Is there any serious objection to placing all this lighting load on one transformer connected to only one phase? What is the custom of other power companies in handling lighting in factory plants of this kind?—C. L. M., Buffalo, N. Y.

Answers.

No. 430.—Reducing Noise of Elevator Controller.—The machinery and control panel for an electric elevator in a small hotel are located at the top of the open shaft, directly above the fifth or highest guest floor. Guests occupying rooms on this floor close to the shaft complain of the noise made by the controller switches, which are of the clapper magnet type. The elevator operates very satisfactorily except for this annoyance. What can be done to stop it? Can another type of switch be used on the controller?—T. N. S., Austin, Texas.

Answer A.—I do not believe that another type of switch would eliminate the noise. The best method would be to have the control equipment located at the bottom of the shaft where the noise would not be so objectionable. In case of a hotel it is possible that the investment necessary for the change would be repaid by having satisfied guests.—H. E. W., Chicago, Ill.

Answer B.—All elevator control sets make considerable noise due to the necessary rapid make and break of the control switches. As a rule this is entirely unobjectionable. In case of a hotel, hospital or the like, where absolute quiet is needed at least by night, it is usually possible to place the control panels in a separate room adjoining the room where the elevator hoisting machines are installed. The walls and door of the controller room should be made soundproof and the door provided with a good spring so it will remain closed. Special ventilation should be provided by a flue running to the roof. This arrangement is also desirable from the fire insurance standpoint.—J. B., Los Angeles, Cal.

No. 431—Relieving an Overloaded Transformer.—A 25-kilovolt-ampere three-phase transformer supplies power to a plant that is now running night and day. The transformer is overloaded as much as 15 to 20 per cent at times and is now running close to dangerous temperature. It is a 60-cycle, oil-insulated, self-cooling type stepping down from 2300 to 230 volts, and is placed in a remote and cramped corner of an old engine room. It is impossible to shut down the plant except on Sunday. A larger transformer has been ordered, but delivery is not promised before six months. What may be done in the meantime to relieve the transformer?—J. S. C., Minneapolis, Minn.

Answer A.—Depending on local conditions which would govern the cost, it might be feasible to use one of the following plans:

1. Inclose the transformer in a metal case and provide a flue to the outside air and a small ¼-horsepower ventilating motor to supply cooling air.

2. Tap a hole in the case just below the oil line and connect a Ford or similar automobile radiator to this hole and the lower drain plug hole. Supply about five or six gallons of extra transformer oil. This should allow considerable overload to be carried continuously. If desired to lower the temperature further the radiator might be provided with a casing and air supplied to it by a ventilating motor or even blown against it by an ordinary fan motor. Also the radiator could be placed in running water. The radiator should be new and must be thoroughly dried out before using it in this manner.—H. E. W., Chicago, Ill.

No. 432.—Ampere-Hour Meter in Place of Watt-Hour Meters.—Now that public service commissions are insisting on voltage regulation within a few per cent from a standard, such as 115 volts, would it not be a fair plan to allow central-station companies to install ampere-hour meters instead of the now standard watt-hour meters for new residence and other small customers? How much saving in meter and wiring expense would be obtained per customer? Would this eliminate meter losses?—A. F. B., New York, N. Y.

The substitution of ampere-hour meters for watt-hour meters is open to objections on part of both the consumer and the central station. Ampere-hour meters of the electrolytic type are out of the question and the motor type meter is not more accurate than the watt-hour meter. In fact the ampere-hour meter is not developed up to the point of the efficiency of the watt-hour meter. The cost would not be much decreased as regards installation, and the chief element of expense with a small consumer is the cost of meter reading and billing, which would remain the same in either case.—H. E. W., Chicago, Ill.

New Appliances

Reverse-Power Relay—Polyphase Cable—Farm-Lighting Plants—Brake—Marine Fixtures—Motor-Driven Machines

POLYPHASE INDUCTION REVERSE-POWER RELAYS.

The polyphase induction reverse-power relay illustrated herewith will operate correctly on practically all single-phase short-circuits, even though the voltage between two lines which are short-circuited may fall to zero; it will also operate on balanced three-phase short-circuits with 10 amperes secondary and one per cent of normal voltage remaining, and in practically every case for balanced short-circuits, with a voltage of one-half per cent normal. (When the voltage falls to such a low value—one-half per cent of normal—however, system conditions are apt to be so distorted that positive operation cannot be assured in every case with any relay.)

The relay is constructed along the lines of a polyphase watt-hour meter, but with three instead of two driving elements. Each of the elements has a current and a potential coil.

Two disks connected to a single operating shaft are used, the upper one of which is driven by one element and the lower by two elements, one in front and one in back.

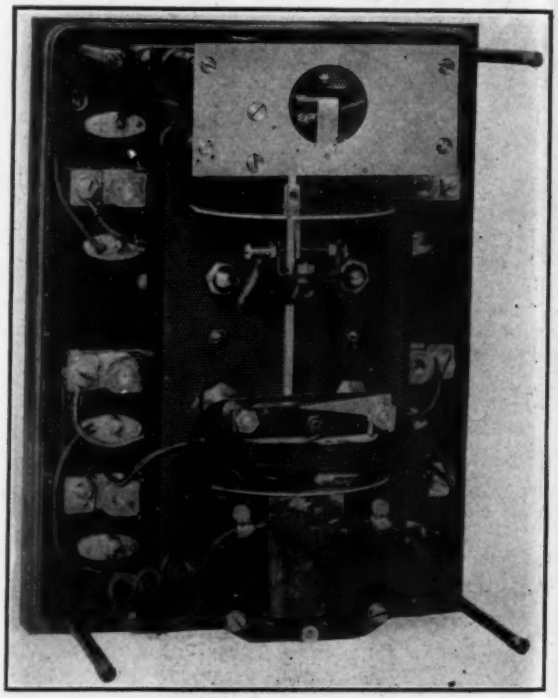
The use of three elements is required for grounded Y-connected circuits and is a distinct advantage even when the relay is used on ungrounded circuits. If two elements were used, many single-phase troubles would involve only one of the elements and the benefit of polyphase action would be lost. Although only one element may be involved in case of a ground on a grounded Y circuit, the voltage triangle will not become so badly distorted as when a single-phase line-to-line short exists. For ungrounded circuits two current and two potential transformers are sufficient. The third current coil carries the resultant current of the two current transformers and the third potential coil is connected across the open delta of the two potential transformers.

The polyphase construction makes the action of the relays more reliable than three single-phase relays, because any incorrect tendency on the part of one phase is balanced by a similar but opposite incorrect tendency on some other phase. The incorrect tendencies being balanced out, the true power direction will control the operation.

The relays are built with single or double-throw contacts, which, however, carry for only an instant the tripping current of the automatic circuit-opening device because the closing of these main contacts sends the entire tripping current of the breaker being protected through the operating coil of an auxiliary relay within the case of the reverse-power relay and causes its contacts to close and short-circuit the main relay contacts.

These auxiliary contacts are sealed closed by the tripping current until the trip circuit has been opened by means of an auxiliary switch on the air or oil circuit-breaker. The breaking of the tripping current by this auxiliary switch permits the auxiliary relay to open.

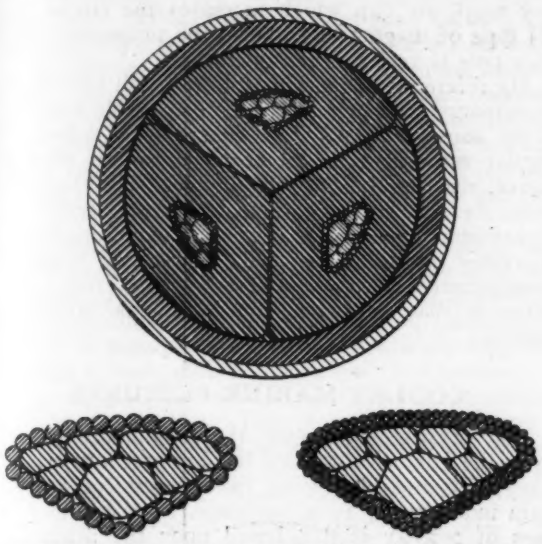
Vibration is practically eliminated even at very heavy currents. The relays are made sensitive in order to operate properly on very low potentials. Thus overload relays must be used in conjunction with the reverse-power relays to prevent operation at normal potential until a predetermined current and time are reached. The contacts of the overload and reverse-power relays are connected in series so that both must close to trip the breaker. Any type of overload relay can be used, but the plunger type is recommended when instantaneous action is desired. The time and current settings of the overload relay determine the action of the combination.



Induction Type Polyphase Instantaneous Reverse-Power Relay With Cover Removed to Show Internal Arrangement.

UNIQUE METHOD OF MAKING STRANDED-CONDUCTOR CABLES.

To economize space in making insulating cables with stranded conductors, Henry W. Fisher (of Huguenot Park, N. Y.) first compresses stranded conductors into bundles having a sector-shaped section, then surrounds each bundle with one or more layers of uncompressed and round-edged conductors, and afterwards molds insulation around this to form a sector-sectioned part of the finished cable. In this way



Cross-Section of Fisher's New Patented Multiple-Conductor Cable, and Enlarged Sections of Typical Stranded Sector-Shaped Conductors.

he claims to secure the flexibility of the stranded-conductor cable without the excessive size required with ordinary methods. It will be observed that this also gives a more uniform thickness of insulation between the conductors themselves and between the conductors and the outer lead or other casing or sheath than is possible with the ordinary construction of multi-conductor cable wherein each conductor, whether solid or stranded, is substantially circular. The patent (U. S. No. 1,266,006) was assigned to the Standard Underground Cable Company, of Pittsburgh, Pa.

FARM LIGHTING PLANTS BEING SOLD BY ELECTRICAL CONTRACTORS.

Electrical contractors are now in the farm lighting-plant business seriously and are finding it necessary to supply their customers with outfits of a better class than the cheap plants sold during the earlier days of the business. Farmers and others who buy these plants know it is economy to buy the best and responsible dealers are not willing to handle any outfits that are not known to be reliable and backed by a substantial manufacturer.

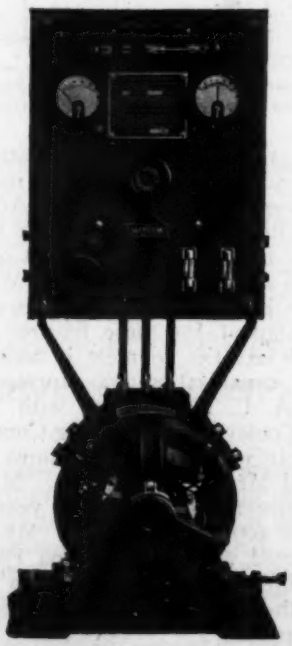


Fig. 1.—Mayhew-Belted Farm Lighting Plant.

The Mayhew-Electric plant shown in Fig. 1 has been placed on the market by the Mayhew Company, Milwaukee, Wis., to meet this condition and the plant and the entire sales policy regarding it have been worked out to give the dealer the best possible proposition and to eliminate the petty annoyances that have been encountered previously in handling this business.

The plant is of the belted type and consists of a generator and switchboard made in one unit and a storage battery which is shipped separately. The generator and switchboard are shipped in one box, the batteries are packed in two boxes so as to keep the weight of each box as low as possible and permit of more careful handling while in transit. The special method used in packing the batteries has entirely eliminated the breakage in shipment formerly so common.

The various elements of the plant are of well known standard makes. The generator is made by the Peerless Electric Company, Akron, Ohio; the batteries by the Globe Electric Company, Milwaukee, Wis. Jewell instruments and a Cutler-Hammer rheostat are used on the switchboard, which also includes a Mayhew-Electric cutout, which is of an improved design and positively guaranteed. Glass fuses are furnished.

These plants are made in three standard sizes provided with batteries of 60, 90, and 120 ampere-hour capacities, respectively. The generator has a capacity of 800 watts.

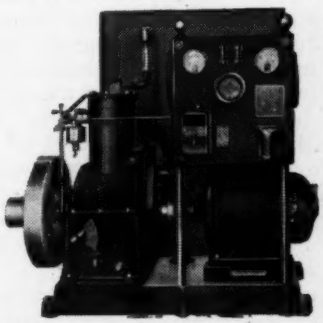


Fig. 2.—Mayhew Type K Direct-Connected Plant.

Another lighting plant for farm and country-home use which has been attracting a great deal of attention for some time is the type K Mayhew-Electric, manufactured by the Mayhew Company. It is illustrated in Fig. 2. Longer battery life and the elimination of engine trouble are two objects that appear to have been successfully accomplished in the design of this lighting set. Its outstanding features are simplicity of engine design and effectual control of the charging rate while the batteries are being charged.

The engine is of the four-cycle, water-cooled type, and follows automobile practice quite closely, employing only features that have been thoroughly tried out and found to be absolutely reliable. Any one who has had automobile experience can make all incidental repairs or adjustments that may be necessary on the engine, so that the outfit is one that the dealer can handle without finding it necessary to establish a service department.

The engine has considerable surplus power over that required for driving the generator and a pulley

has been provided so that the outfit can be used for power purposes as well as lighting. The engine is started by pressing a small lever and the same lever is used to shut down the outfit when the batteries are charged. At a slight additional cost the outfit may be equipped with a device for automatically shutting down the engine when the batteries are fully charged. This is a feature which has served as an effective talking point on direct-connected sets, but in practice has been found to be unimportant. It is for this reason that the makers of this plant furnish this as an extra and by doing so are able to furnish the outfit at a correspondingly lower price.

The switchboard is provided with a voltmeter and ammeter and also a rheostat for controlling the rate at which the batteries are charged. It is a well known fact that in lighting-plant service storage batteries can be made to last for from 6 to 8 years by properly taking care of them, and particularly in the matter of avoiding charging the batteries at too high a rate. In the Mayhew plant provision has been made to permit of giving the batteries the kind of attention that makes for long life and satisfactory service.

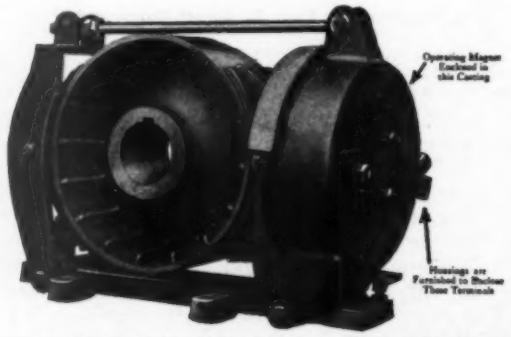
The generator has a capacity of 800 watts and batteries of various sizes are furnished to meet any condition encountered in farm home lighting. The engine and generator unit are the same in all cases.

The plant takes up very little room and requires a minimum amount of attention, and the operating cost is low. It appears to be a plant that meets the present demand in a most satisfactory manner.

NEW MAGNET-OPERATED BRAKE.

Recent improvements in the magnet-operated brake built by the Cutler-Hammer Manufacturing Company, Milwaukee, Wis., have given it several distinguishing features. By lowering the position of the magnet and making the magnet armature an integral part of one of the arms carrying the brake shoe, the construction has been simplified, fewer parts are required, compactness is secured, and the parts made extremely strong and rugged without adding excessive weight. The new design requires less headroom, as it is but slightly higher than the brake wheel—a point to be considered when a brake of this kind is to be installed on a crane, hoist, or bridge.

Many desirable operating features have also been



Improved Magnet-Operated Brake for Cranes, Hoists, Etc.

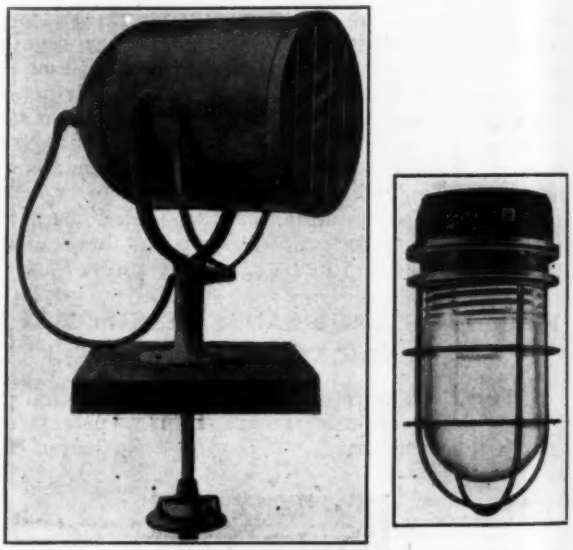
secured. The brake is applied by means of a spring, located in the center of the coil, which tends to force the armature and magnet apart. The force acts directly in line with the center of the brake shoes, thus the operation is not affected by any wear in the brake linkage, and the retarding torque exerted on the brake wheel is the same in both directions of rotation. The magnet is of the iron-clad clapper type working on a very small air gap which increases the efficiency of this type of magnet and due to the projection on the outer pole is very quiet in operation.

By reference to the illustration it will be seen that the armature and magnet are both movable and rotate on the same centers. This construction reduces the angular movement of all bearings to less than one degree, making the wear negligible. This also eliminates the side friction, found in magnets which have the armature mounted on a member extending through the center of the magnet coil. These new brakes are manufactured in standard sizes varying from 8 to 30 inches in diameter, and from 15 to 300 horsepower capacity.

COOLEY MARINE FIXTURES.

The phenomenal growth of the shipbuilding industry in the Pacific Northwest has brought into existence many new and interesting lines dependent upon the main industry for their existence. One of these new lines of activity is that based upon the demand for marine electrical fixtures and supplies.

Even before the entry of America into the war



The Cooley Incandescent Searchlight for Shipboard Use and One of the Cooley Water-Tight Marine Fixtures.

there was a growing demand for water-tight marine fixtures, and some effort was being made in isolated instances to meet that requirement. Among those engaged in this line of work was George R. Cooley, formerly of the firm of Buxbaum & Cooley, electrical engineers and contractors of Seattle, Wash., and later of the George R. Cooley Electric Company.

As the demand for these fixtures increased, the quarters and facilities to meet it became inadequate and another organization was formed. Burton C. Dinius and A. C. Hale joined with Mr. Cooley in forming the Cooley Manufacturing Company, of which Mr. Cooley is president, Mr. Dinius treasurer and manager, and Mr. Hale, secretary. Mr. Dinius is an electrical engineer and for several years was engaged in that line of activity in Chicago. Mr. Hale was formerly connected with the Montana Power Company. The main object of the new concern is to carry on extensively the manufacture of marine electrical fixtures and supplies.

A busy plant has been fitted up at 1722 22nd Ave-

nue South, Seattle, but owing to the growth of demand this will not suffice beyond another year. Much equipment has been installed and this is being constantly augmented by new devices. This includes universal turret screw machines, engine lathes, specially equipped drill presses and full equipment for the brass finishing shop. Included in these facilities is a completely equipped foundry with two melting furnaces and large core oven, giving opportunity for any kind of work in brass, bronze or copper.

At present, all the demands of J. F. Duthie & Company, who are constructing steel ships on a large scale at Seattle, are being met, aside from filling large orders from local supply houses. With present facilities it is possible to supply equipment for practically two 8800-ton ships a week, each requiring over 300 fixtures.

Among the fixtures made is the Cooley incandescent searchlight, type B-2. This is described as having no mechanism to get out of order, no trimming, focusing or adjusting. It is equipped with a special mirror, stripped glass front, concentrated-filament nitrogen-filled Mazda lamp of voltages from 6 to 120. The light is controlled from within the pilot house, both vertically and horizontally, with one handle, the range depending upon the size of lamp used, condition of the atmosphere and the nature of the object sought. This searchlight and several other appliances being made by the company are covered by patents. The fixture designated as No. 6041 and illustrated herewith is a compact water-tight fixture, with lamp grip receptacle, vaporproof globe and guard mounted either on a brass or iron outlet box and is one that is meeting with much favor in the shipbuilding industry.

As to the fixtures being water-tight, the company is exhibiting one of its No. 70118, a brass bracket type in one piece with lamp grip receptacle vaporproof globe and guard, which was sunk with the steamer *Northland* and remained under water for one year. Upon examination after recovery the inside was found to be perfectly dry.

A MOTOR-OPERATED BREAD-WRAPPING MACHINE.

Bread wrapping has become a regular part of bread production as a result of public demands that it be delivered to the customer clean, sanitary and unhandled. Obviously, wrapping must be done by machinery to assure these results and to perform the operation at lowest possible cost.

As a result of this requirement the National Wrapping Paper Company, Nashua, N. H., has developed a motor-operated wrapping and sealing machine, under the Sevigne patents. This machine performs the entire operation, receiving the loaves from the ovens and delivering them ready to hand to the customer.

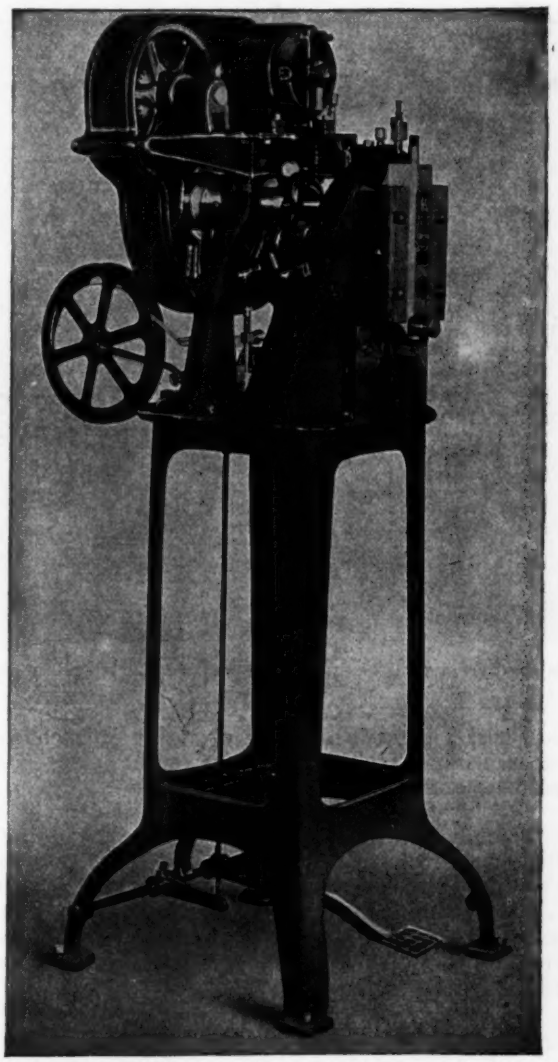
Power for the entire operation is furnished by a fractional-horsepower motor made by the General Electric Company, for the prevailing current.

MOTOR-DRIVEN BOX-CORNER-STAYING MACHINE.

The Knowlton corner-staying machine makes a strong and high-grade box by forcing the sides of the box and the stay together under great pressure, forming a corner stronger than the board. The board is neither punctured nor weakened but stiffened by the continuous fastening, and reinforcement is secured at each box corner.

This machine is manufactured by the M. D. Knowlton Company, Rochester, N. Y. A Westinghouse motor, which can be connected to the lighting circuit, provides the power. It is mounted on the top of the frame and is geared direct to the machine for individual drive. The stayer can be mounted on casters so that it can be easily moved about the factory to any desired place.

A feature of the machine which is of special interest is the Knowlton safety device which replaces the old style driving link in the machine head. It serves a double purpose—of a pressure transmission and as a protection to the operator. The safety device is designed in such a manner, that when the head is lowering, there is no driving connection until the head comes within a distance of approximately 5/32 inch of the anvil. Any obstruction thicker than this prevents the device from locking and so exerting pressure. Thus, this makes it impossible for the operator to be injured between the head and the anvil.



The Knowlton Box-Corner Stayer With Safety Device.

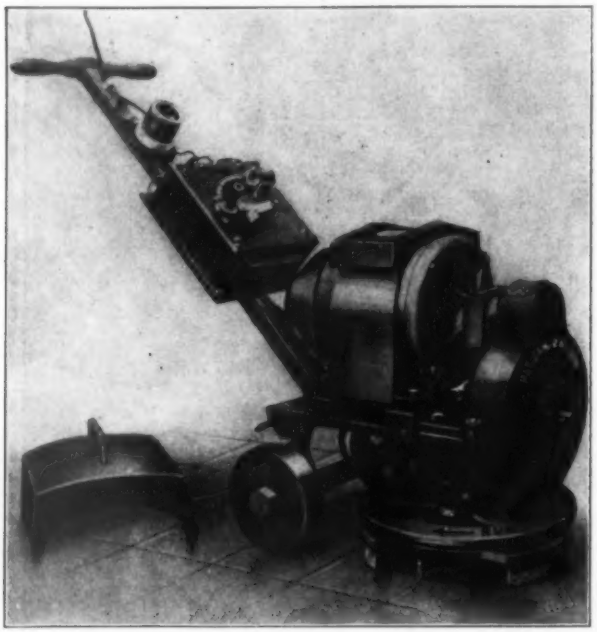
STANDARDIZED REFLECTORS.

Just as we go to press announcement has been received of the development of standardized steel reflectors. These will be described in an early issue.

MOTOR-OPERATED FLOOR-SURFACING MACHINE.

The Cavicchi Polishing Machine Company, Quincy, Mass., has developed, in two sizes, a one-man type of motor-operated floor-surfacing machine for surfacing and maintaining tile, marble, granolitic and composition floors.

A smooth finish fully up to the baseboards on the sidewalls is obtainable and by means of a wheel com-



Motor-Driven Machine to Save Time and Labor in Finishing Floors.

posed of concentric sections, operating independently of each other, irregular surfaces can be brought to a uniform and smooth surface.

Rapid and very satisfactory work is done by the machine, which represents a very important saving in the time and labor cost of finishing floors, usually a very slow and laborious process when done by hand.

The machine is actuated by a 2-horsepower motor, made by the General Electric Company. The motor speed is controlled by the switch and rheostat located on the handle of the machine.

CHAIN GRIP PIPE VISE.

This is an efficient, speedy, portable tool much used in pipe and conduit work. The parts are of malleable iron and steel, and stand severe tests. The supporting chain, one end of which is fastened to the base of the vise, is passed through the tightening eye-bolt of the clamp support at the back of the column, and a link drops into a recess on the opposite side of the vise base. The vise base fits any round or square column.

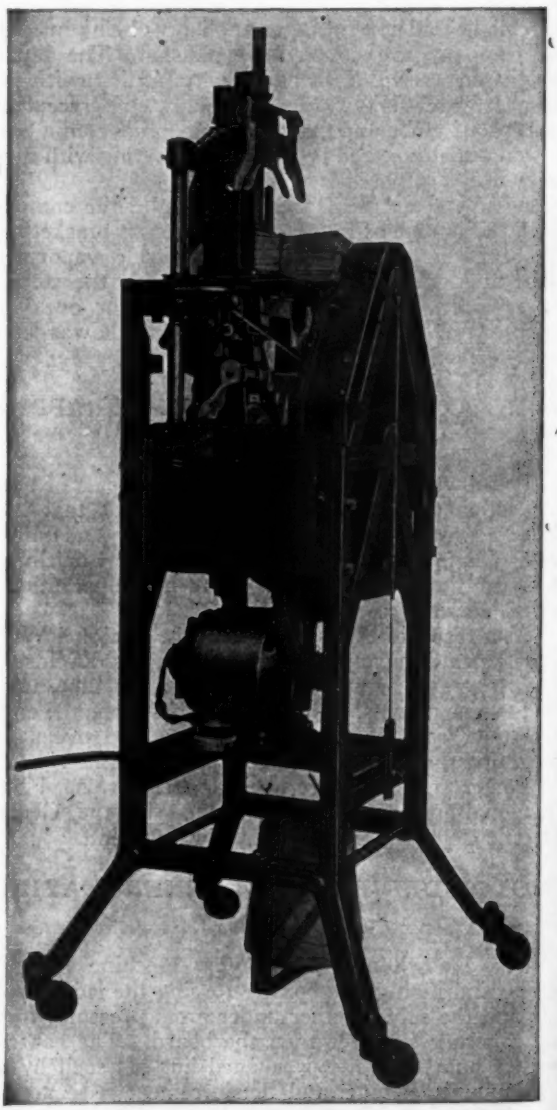
When the heavy gripping chain is wrapped around a pipe, held by the toothed steel jaw, the chain is hooked in the steel socket, and the lever is applied, locking the pipe firmly for threading or cutting. The eccentric force multiplication exerted by the lever is controlled as to any desired tension by an adjusting bolt. The matter of loosening the pipe, after the work is completed, is quickly accomplished by pulling out the lever and unhooking the chain. The chaingrip vise is one of the products of the Gerolo Manufacturing Company, Old Colony Building, Chicago.

MOTOR-DRIVEN PACKAGE-TYING MACHINE.

Neater and more uniform packages can be tied, in the same time, it is claimed, by the Bunn packing-tying machine, made by B. H. Bunn & Company, Chicago, Ill., than can be done by five men. In fact, the accuracy and dependability of the machine has been so well proved that the United States Post Office Department has adopted it for tying letter mail.

The package tier is simple and very compact, occupying a space only 1 ft. square. The motive power is a little Westinghouse motor located in the lower part of the machine. It can be attached to an electric light socket and uses but little current.

Each bundle is tied securely in the same way every time. A non-slip knot prevents the string from slipping and allowing the package to become loose. One wrapping only of the twine each way eliminates the waste of twine where several wrappings by hand process were ordinarily made. Thus, much saving of labor and economy is effected by the use of this machine—both matters of great moment at any time and especially just now.



The Bunn Package-Tying Machine, Which Does the Work of Five Men.

Current News

Weekly Record of Construction Activities—Conventions

EASTERN STATES.

NEWBURYPORT, MASS. — Newburyport Gas & Electric Company has acquired a site on the Merrimac river for the construction of a new central power station. The property embraces the territory heretofore held by the Edward Perkins Lumber Company, the Ling Packing Company and the Woods estate, consisting of a frontage of about 500 feet along the river. It is said that the new plant will cost over $7,500,000, including proposed distributing system over a radius of about 25 miles.

NORTHAMPTON, MASS.—Hampshire county commissioners have decided to equip the town farm buildings with electric light power plant. Address county clerk.

TURNERS FALLS, MASS.—Turners Falls Power & Electric Company has awarded a contract to Fred T. Ley & Company, 499 Main street, Springfield, for alterations and improvements in its plant.

HARTFORD, CONN.—Fire recently damaged a section of the foundry and model room of the Connecticut Electric Steel Company, Flatbush avenue. It is understood that the destroyed portion will be rebuilt immediately.

NEW LONDON, CONN.—New London Ship & Engine Company has filed plans for the erection of a new one-story power plant, about 50x90 feet, to be used for works operation. Contract for the structure has been awarded to the J. H. Grozier Company, 781 Main street, New London.

BROOKLYN, N. Y.—The United States Government, Navy Department, Bureau of Yards & Docks, is having plans prepared for extensive improvements in the central power plant at the local navy yards.

MECHANICSVILLE, N. Y.—Halfmoon Light, Heat & Power Company has filed notice with the Public Service Commission of an increase in its capitalization from $150,000 to $200,000, to provide for expansion.

SYRACUSE, N. Y.—Notice has been filed with the Public Service Commission by the Oswego River Power Transmission Company, operating in Onondago County, of an increase in its capital from $20,000 to $50,000, to provide for business extensions.

MORRIS, N. Y.—The citizens have voted to light the streets with electricity. The Lynn Tractor Company will be given the contract for lighting.

CAMDEN, N. J.—Plans have been prepared by the New York Shipbuilding Corporation for the erection of a large power plant for works operation, in connection with the expansion program of the company. Work has been commenced on the construction of four new shipways, plate and angle shop, machine shop, copper shop, and auxiliary structures.

MAYS LANDING, N. J.—Bethlehem Loading Company, which now has in course of construction a large shell-loading plant, has awarded a contract for the erection of a boiler plant at its works to cost in the neighborhood of $16,000. Albert Doak, 2138 Arch street, Philadelphia, Pa., is the contractor.

MORRISTOWN, N. J.—Morris & Somerset Electric Company is planning for extensions to its power house, to cover an area of approximately 18,000 square feet of floor space.

PERTH AMBOY, N. J.—In connection with the construction of the proposed new 40,000,000-gallon capacity reservoir to increase the present water supply system, a new high-service electrically-operated pumping station will be erected on Carlock avenue, designed to house two pumping units of 1,000,000-gallons daily capacity each. George A. Johnson, 150 Nassau street, New York, is consulting engineer for the water board.

POMPTON LAKES, N. J.—Until August 7, bids will be received by the Borough Council for the erection of the proposed new addition to the municipal power plant. A bond issue for $46,000 was recently approved for the work, which was later increased to $56,000.

SOUTH AMBOY, N. J.—The City Council has requisitioned an appropriation of $6000 in its annual budget, to be used for the operation of the electric-street-lighting system.

WILDWOOD, N. J.—West Jersey Electric Company has been granted permission by the Board of Public Utility Commissioners to increase its rates for electric service by discontinuing the discount allowance heretofore in effect for payment within five days from the presentation of bills.

EASTON, PA.—Pennsylvania Utilities Company is making rapid progress in the installation of the new 10,000-kilowatt turbine, and it is expected that operations will be inaugurated by September 1.

HAZLETON, PA. — Worthington Pump & Machinery Company has completed plans for the construction of an electric power station to cost about $50,000. The plant will be located underground and will be used in connection with a new extension to the company's works to cost about $200,000.

PHILADELPHIA, PA.—The city, department of public safety, is having plans prepared for the installation of new equipment at the municipal repair plant at Eleventh street and Reed avenue, including new motor generators, air compressors, boilers, etc. The work is estimated to cost $40,000.

PHILADELPHIA, PA. — Midvale Steel & Ordnance Company, Widener building, has had plans prepared for the erection of a one-story electric power plant, about 55x120 feet, to be constructed at its Nicetown works. The structure will cost about $25,000.

PHILADELPHIA, PA.—The United States Government has awarded a contract to Thomas Reilly, 1616 Thompson street, for extensions in the transformer plant at the aircraft factory at the League Island Navy Yard.

PHILADELPHIA, PA. — C. H. Wheeler Company, Eighteenth street an Lehigh avenue, has awarded a contract for the erection of a new addition to its boiler plant, about 40x55 feet. to cost $9000. John N. Gill & Company, Otis building, is the contractor.

WASHINGTON, PA.—Electric Reduction Company is planning to commence work at once on the erection of a new two-story machine shop and boiler plant at its works, about 30x60 feet. The structure will cost $15,000. Contract has been awarded to the Austin Company, Cleveland, Ohio.

BALTIMORE, MD.—Chesapeake & Potomac Telephone Company, Lexington street, is planning to increase its capital from $10,000,000 to $15,000,000 to provide for business extensions.

HOLDEN, MD.—Architects Archer and Stevens, New England building, Kansas City, are preparing plans for a $30,000 municipal electric light plant. Address city clerk.

SHENANDOAH, VA.—The city offers for sale $30,000 hydroelectric bonds. Address W. S. Long, mayor.

WHEELING, W. VA.—The city authorities are trying to decide on a new lighting system to replace the present system in use. When the new lighting system has been decided on the matter of whether the city will purchase power or manufacture it will be taken up.

RALEIGH, N. C.—The board of managers of the Central Hospital for Insane has awarded a contract for the erection of a new extension to its power house at the institution to cost about $23,000. Extensive improvements will be made, including the installation of new boilers, electric power and heating equipment, etc., the entire work being estimated to cost $90,000.

COMMERCE, GA.—The city has sold $15,000 in bonds for improving the electric light system. Address the mayor.

DADE CITY, FLA.—Dade City Ice, Light & Power Company is considering plans for the installation of new equipment to provide for an increase in the present capacity of its plant.

MONTICELLO, FLA.—The city is planning a bond issue for $17,500 to provide for the acquirement of the local electric light and power plant. J. M. Johnson is mayor.

SOUTH JACKSONVILLE, FLA.—The city has voted $100,000 bonds to extend electric light, sewer and water systems to 300 dwellings to be erected by the Emergency Fleet Corporation. Address the mayor.

WAUCHULA, FLA.—The city nas voted $20,000 to purchase the Wauchul Light & Power Company's electric light plant and $4000 for additional machinery. Address the mayor.

NORTH CENTRAL STATES.

CANTON, OHIO.—The electric power supply in Canton, furnished by the Central Power Company, will be materially increased with the completion soon of the third unit of the new power plant at Windsor, W. Va. The plant will cost approximately $3,500,000, according to officials of the company.

NELSONVILLE, OHIO.—$2500 will be expended for improving the electric light plant. Address A. W. Linton, city clerk.

STRUTHER, OHIO.—Struther Furnace Company will expend $500,000 increasing the efficiency of its plant. New electric equipment is included in the specifications.

ANGOLA, IND.—August 5 bids will be received for an electric light plant to furnish light for the county infirmary. Address Irvin W. Pence, county auditor.

INDIANAPOLIS, IND.—The Indiana state board of tax commissioners has under advisement appeals from the Indianapolis Light & Heat Company and the Merchants Heat & Light Company from the valuation for taxation purposes, fixed on those properties by the Marion county board of review. The companies are showing the state board of tax commissioners that their desire for added surcharges on all bills is to enable them to operate without deficits. The Indianapolis Light & Heat Company would have operated with a deficit of $112,000 for the year ended June 30, 1918, except for the surcharges and the Merchants Light & Heat Company would have sustained a deficit of $238,793 except for the benefits derived from the additional charges.

JEFFERSONVILLE, IND.—Among the improvements which the Government railroad administration has authorized the Pennsylvania Railway Company to do in this city are the installation of a 100-foot turntable, operated electrically; first section of machine shops, each unit to be 40x100 feet and to be added as needed; a roundhouse capable of housing 12 large locomotives; a repair shop; a new passenger station; double tracks from the bridge to the junction with the old line and yards of 18 tracks capacity.

CARMI, ILL.—$6000 in bonds have been voted to improve the water and light system. Address city clerk.

ELGIN, ILL.—The Illinois Public Utilities Commission has authorized a temporary increase of 25 per cent over the present rates for electric lighting and 33⅓ per cent for electric power by the Aurora, Elgin & Chicago Railroad Company and by the Elgin Merchants Light Company.

SPRINGFIELD, ILL.—Skip stops will be installed by the Springfield Consolidated Railway Company in an effort to conserve fuel. Springfield is one of the first medium-sized cities in the Central West to adopt the skip-stop plan. There will be eight stops per mile in the business district, six stops per mile in the residence section and four stops per mile in the open country. About 30 per cent of the stops will be eliminated.

DATES AHEAD.

Association of Iron and Steel Electrical Engineers. Annual convention, Southern Hotel, Baltimore, Md., September 9-14. Secretary, John F. Kelly, McKeesport, Pa.

Northwest Electric Light and Power Association; affiliated with N. E. L. A. Annual convention, September 11, 1918. Secretary, George L. Myers, Pacific Power & Light Company, Portland, Ore.

International Association of Municipal Electricians. Annual convention, Atlanta, Ga., September 24-27, Secretary, Clarence R. George, Houston, Tex.

New England Section of the National Electric Light Association. Annual meeting, Hotel Kimball, Springfield, Mass., September 27 and 28. Secretary, Miss O. A. Bursiel, Boston, Mass.

American Electrochemical Society. Fall meeting, Princeton, N. J., September 29 to October 1. Secretary, Prof. J. W. Richards, Lehigh University, Bethlehem, Pa.

American Electric Railway Association. Annual meeting, Atlantic City, N. J., October 8 and 9. Secretary, E. B. Burritt, 8 West 40th street, New York City.

Kansas Public Service Association. Annual meeting, Kansas City, Kans., October 17-19. Secretary-treasurer, W. W. Austin, Cottonwood Falls, Kans.

BERRIEN SPRINGS, MICH.—The Indiana & Michigan Electric Railway has petitioned for authority to dam St. Joseph river, above its various dams at St. Joseph with a view of getting additional power for war work. Address Fred Brown, manager, Berrien Springs.

GRAND RAPIDS, MICH.—The directors of the Michigan Railway Company will build an electric line from Morrice to Flint. Address C. E. Morgan, general superintendent, Grand Rapids, Mich.

WORTHINGTON, MINN.—Specifications for a water and light plant have been prepared by Charles L. Pillsbury Company, architect, Metropolitan Light building, Minneapolis. Address W. H. Buchen, city clerk.

CLINTON, IOWA.—Klein Paper Company is preparing plans for a paper mill, including power plant, motors, pumping machinery, etc., at an estimated cost of $175,000.

FLAT RIVER, MO.—Missouri Public Utilities Company, which furnishes electric current for all of the Lead Belt towns, has made application to the State Public Service Commission to increase the rates for the service furnished this district.

SIKESTON, MO.—Mayor Malone is in receipt of notice from the state public service commission that they will give a hearing on the Missouri Public Utilities Company on its petition for permission to raise the rates to consumers in Sikeston. The citizens of the city will probably hold a mass meeting and organize to fight the raise asked for.

HOLDEN, MO.—Holden Electric Light Company is planning for the immediate reconstruction of its power plant recently destroyed by fire. Plans for the structure are now in course of preparation by Archer & Stevens, Kansas City.

NOVINGER, MO.—Merchants' Light & Power Company's plant has been damaged by fire.

SMITH CENTER, KANS.—An ordinance has been passed regulating the operating and maintenance of the Exchange Telephone Company within the corporate limits of Smith Center, and granting a franchise thereof. H. W. Mackey, city clerk.

TOPEKA, KANS.—The public utilities commission recently heard applications for two bond issues. The Kansas Gas & Electric Company of Wichita sought permission to issue $475,000 worth of bonds, while the Home Light, Heat & Power Company of Pittsburg asked approval of a $76,000 bond issue. Both applications were taken under advisement.

HOMER, NEB.—The question of issuing $7500 in bonds for improving the electric light plant will be submitted to vote. Address city clerk.

O'NEILL, NEB.—Fire recently destroyed the creamery plant and electric light plant owned by McGinnis Creamery & Produce Company. Loss $40,000, insurance $20,000. They will be rebuilt.

PALMER, NEB.—The citizens of Palmer voted in favor of a bond issue of $40,000 for the erection of a water and light plant.

HURON, S. DAK.—Farmers' Cooperative Packing Company will build an electric power plant in connection with its packing house. L. F. Shuttleworth, manager.

SOUTH CENTRAL STATES.

ANNISTON, ALA.—An electric railway will be constructed between Anniston and Fort McClellan. Address Whit Clark.

HUNTSVILLE, ALA.—Waddell & Sons, Kansas City, Mo., will have charge of the construction of an electric railway to run between this city and Florence, Ala. Address J. M. Phillips, chief engineer.

ASHDOWN, ARK.—Commonwealth Public Service Company is considering plans for the installation of new machinery at its electric-lighting plant, including dynamos, engines, etc.

DEQUEEN, ARK.—Commonwealth Public Service Company, of Muskogee, operating a chain of electric plants and ice plants in Arkansas and Oklahoma, has purchased the Arkansas Light & Power Company's plant here. The Commonwealth Company recently acquired the electric plant and ice plant at Mena.

NASHVILLE, ARK.—Most of the buildings burned here last week at a loss of approximately $15,000, the telephone company being one of the heaviest losers.

ENID, OKLA.—Owing to increase in power business, the Enid division of the Oklahoma Gas & Electric Company reports that its day peak load now often exceeds the night peak, and that with the beginning of operation of the flour mills this will be increasingly so.

MIAMI, OKLA.—The council has the budget before it for passage upon for the ensuing fiscal year, in which estimates have been submitted by the various departments. The water and light departments estimate of $60,000 is largest. It is expected however that revenues from water and light plant will meet expenditures.

WAPANUCKA, OKLA.—The water and light bonds have been sold to C. Edgar Honnold, of Oklahoma City. The contract for the work will be let at once.

OKLAHOMA CITY, OKLA.—About 35 citizens of Burkburnett, Tex., have petitioned the Oklahoma Corporation Commission to prevent the Burkburnett Telephone Company discontinuing service to patrons of the line across Red River in Cotton county, Okla. The commission will make an investigation.

OKLAHOMA CITY, OKLA.—Oklahoma Gas & Electric Company will erect a concrete and wood cooling tower to cost approximately $72,000.

POTEAU, OKLA.—Citizens' Consolidated Power & Electric Company has been granted a franchise to furnish electricity to the industrial plants. The company will furnish the city with electricity for the white way system.

DALLAS, TEX.—Dallas Power & Light Company is planning for the erection of a new brick and concrete addition to its plant to cost $15,000.

SOMERVILLE, TEX.—Gulf, Colorado & Santa Fe Railway will erect an electric power house. Address F. Merritt, chief engineer, Galveston.

WESTERN STATES.

SPOKANE, WASH.—Plans are being discussed for erection of an electric furnace for the production of alloys for war uses on a site to be furnished by the Washington Water Power Company, which is to furnish the power for experimental purposes.

WENATCHEE, WASH.—A franchise has been granted by the county commissioners to the Chelan Water Power Company for constructing a pole line from Entiat to Maple Creek. This is to constitute a part of the equipment of the new power plant to be erected at Chelan.

PORTLAND, ORE.—Parker & Banfield, local contractors, were awarded contract at $5260 for constructing the generator plant at the Washington end of the interstate bridge.

LOS ANGELES, CAL.—The City Council has approved plans for the early installation of a new ornamental electric-lighting system on Broadway, to cost about $100,000.

ONTARIO, CAL.—Ontario Power Company is planning to commence work at once on the erection of a hydro-electric plant in San Antonio canyon, to cost approximately $65,000. The works will have a capacity of about 2,700,000 kilowatts per year.

PALO ALTO, CAL.—Extensive additions to increase the present capacity of its plant will be made by the Federal Wireless Telegraph Company. It is planned to erect several buildings and install the necessary machinery for the handling of a large contract received from the Government for wireless equipment.

SAN BERNARDINO, CAL.—Plans have been completed and contract awarded by the Southern Sierras Power Company for the installation of a new unit in the water cooling system at its local steam-operated electric plant. The work is estimated to cost about $10,000.

SAN DIEGO, CAL.—San Diego Consolidated Gas & Electric Company has recently been authorized to issue bonds for $1,100,000, the proceeds to be used for the erection of additions and extensions in its system.

SAN FRANCISCO, CAL.—Pacific Gas & Electric Company contemplates issuing a $2,000,000 bond issue to provide for added improvements. Address secretary, San Francisco, Cal.

NEW PUBLICATIONS

ANALYSIS OF MINE AND CAR SAMPLES OF COAL COLLECTED IN THE FISCAL YEARS 1913 TO 1916, (Bulletin 123), issued by the Bureau of Mines, Department of the Interior, is a continuation of the sampling and analyzing of the coals of the country begun by the Federal Government in 1904. It is the third of the series, Bulletin 22, "Analyses of Coals in the United States," which can now only be obtained from the Superintendent of Documents, Government Printing Office, Washington, D. C., for 85 cents. The second bulletin of the series, Bulletin 85, "Analyses of Mine and Car Samples of Coal Collected in the Fiscal Years 1911 to 1913," is still available for distribution by the Bureau of Mines. The present bulletin presents analyses and description of samples collected during the fiscal years 1913 to 1916. In order that the material in this bulletin may be used to supplement that presented in Bulletins 22 and 85, the same plan of geographical classification has been followed, the analyses and descriptions of the samples being grouped in alphabetical order according to the state, county and town near which the mines or prospects sampled are situated.

PROPOSALS

CAPSTANS.—Bids will be received until August 5 by the Bureau of Yards and Docks, Navy Department, Washington, D. C., for furnishing electrically-driven capstans at Norfolk, Philadelphia and New York navy yards. Estimated cost $21,000 each yard.

GENERATOR, SWITCHBOARD, ETC.—The City Council of Stillwater, Okla., will receive bids until August 12 for the installation of new electric power equipment at the municipal plant, including one 250-kilovolt-ampere, 2300-volt, three-phase cycle generator, one switchboard for generator, one exciter, one 16-kilovolt ampere, 6.6 ampere constant current transformer, one 300-horsepower, 150-pound steam-pressure boiler, and one 400-horsepower open heater. Address J. L. Moore, Commissioner of Revenue and Accounting.

INCORPORATIONS

THOMSON, GA.—Thomson Light & Water Company has incorporated with a capital of $70,000. R. L. Hadaway.

NEW YORK, N. Y.—H. W. Evans Company. Capital, $20,000. To engage in the manufacture of electrical fixtures and supplies. Incorporators: L. S. Muller, K. R. Miner, and H. W. Evans, 88 Park place.

NEW YORK, N. Y.—Lionel Corporation. Capital, $50,000. To manufacture electric toys and kindred specialties. Incorporators: J. L. Cowen, A. T. Scharps, and M. Frankel, 42 Broadway.

NEW YORK, N. Y.—Electric Motors Corporation. Capital, $20,000. To manufacture electric motors and kindred specialties. Incorporators: G. Katz, S. Feldman, and S. Wetzler, 583 Riverside drive.

NEW YORK, N. Y.—Snow-Whitcomb Company, Inc. Capital, $50,000. To engage in the manufacture of electric lamps, bulbs, etc. Incorporators: W. L. Snow, R. E. Whitcomb, and J. H. Westcott, Jr., 605 West One Hundred and Fifty-first street.

ROCHESTER, N. Y. — Rochester Home Electric Company. Capital, $25,000. To operate a local plant. Incorporators: H. A. Bulk, J. M. and P. E. Illman, Rochester.

HARRISBURG, PA.—North Union Township Electric Company. Nominal capital $5000. To operate a local electric plant. C. M. Walter, treasurer.

ANTREVILLE, S. C.—Antreville Telephone Company has incorporated with a capital of $1000. R. A. Keatan.

ROCK HILL, S. C.—Rock Hill Electric Company has incorporated with a capital of $2000 by J. E. Pryor and others.

HILLSBORO, TEX.—Hillsboro Telephone & Telegraph Company. Capital, $80,000. J. B. Earle, of Waco, is the principal incorporator.

CHARLOTTE, VA.—American Power & Railway Company has been incorporated with a capital of $100,000 to operate electric and steam railways and to generate and transmit electric power. H. M. Victor and D. D. Twawick, incorporators.

RICHMOND, VA.—Liberty Heating Company. Capital, $50,000. To manufacture heating and lighting appliances. Incorporators: John L. Ratcliffe and Allan C. Woodridge.

CHARLOTTE, N. C. — American Power & Railway Company. Capital, $100,000. To operate an electric railway system. Incorporators: H. M. Victor, C. B. Bryant and D. D. Traywick.

WACO, TEX.—Hillsboro Telephone & Telegraph Company. Capital, $80,000. To manufacture telephone and telegraph instruments. Incorporators: J. B. Earle, Waco; A. F. Adams, and H. L. Gary, Kansas City, Mo.

DES MOINES, IOWA.—Norwalk Light & Power Company has incorporated with a capital of $20,000 to furnish light, electricity and power. Frank F. Keithley, president.

Trade Activities

Hart Manufacturing Appoints Representative—New Process Specialty Locates in New Quarters—Special Catalogs

Engineering Department of the U. S. Ball Bearing Manufacturing Company, Chicago, Ill., has just published a booklet entitled "Calculating Bearing Loads," which is a compilation of formulae and calculations necessary to determine the loads on ball bearings resulting from various types of power-transmitting elements. It is divided in eight parts, giving calculations of bearing loads resulting from the belt drive, rope drive, chain drive, spur gear drive, helical gear drive, bevel gear drive, helical bevel gear drive and worm gear drive. Tables and diagrams, showing the bearing loads resulting from the various drives, together with much other valuable data are contained in the booklet.

Cutler-Hammer Manufacturing Company, Milwaukee, Wis., is distributing a four-page standard descriptive booklet, known as Booklet "A," entitled "Motor-Operated Brakes for Alternating Current Service." This booklet points out the application and desirable operating features of these brakes. Two installation views are included, one showing the brake applied to a large mine hoist motor, and the other, to a motor-driven elevator machine. Emphasis is given to the fact that the brake is operated by a special squirrel-cage ball bearing torque motor, and that the brake is applied without destructive hammer blow or shock. Dimensions, engineering data and the formula for determining the retarding torque required for any brake installation are given. The booklet lists the standard sizes, which vary from 8 to 30 inches in diameter and from 12 to 300 horsepower capacity.

Sprague Electric Works of General Electric Company, New York City, has just issued Bulletin No. 48938 on electric grab-bucket hoists, superseding Bulletin No. 902. The bulletin is profusely illustrated and deals at some length with the problem of handling material in bulk in industrial plants by means of mechanical methods. It describes in detail the construction of the Sprague grab-bucket hoist, its methods of control, operation, etc., and points out the many advantages afforded by this apparatus, which has been designed to meet a wide range of conditions. While these cranes have been extensively used in the efficient handling of coal, they have been attended with great success in their wide application to other materials, such as iron pyrites, sand, ashes and cement, and meet the ever-increasing demand for a machine to perform these functions. Included in this bulletin are numerous tables containing data as to capacity, weight, hoisting speed, traveling speed, etc.; also diagrams showing the dimensions of the various types of hoists. Several splendid illustrations, showing typical installations of this apparatus, are also contained in the bulletin.

Electric Supply & Equipment Company, Hartford, Conn., will move its headquarters to Albany, N. Y., where a building will be erected at a cost of $50,000, providing more adequate facilities for the proper conduct of its business.

New Process Specialty Company, Milwaukee, Wis., announces its removal from the Enterprise building to its new factory located at 230-232 Hanover street, which will provide greatly increased facilities for the manufacture of high grade jigs, dies, gauges, tools and special machinery.

National Electrical Signalling Company, Brooklyn, N. Y., manufacturer of wireless telegraph and telephone instruments, heretofore located in the Bush Terminal building, is planning for the establishment of new headquarters through the acquisition of the terminal by the army and navy departments of the Government.

Hart Manufacturing Company, manufacturer of "Diamond H" switches and appliances, Hartford, Conn., announces the appointment of the W. A. McCombs Company, Union Arcade building, Pittsburgh, Pa., as its representative and distributor throughout Ohio, all of Pennsylvania east to Harrisburg, West Virginia and Kentucky. The new agency will aggressively push the complete line of "Diamond H" switches, receptacles and appliances throughout this territory. As this is a well known and aggressive enterprise, it is to be expected that valuable results will accrue through this arrangement of the Hart company.

Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., recently issued a 12-page booklet entitled "Westinghouse Electrical Equipment for Garment Manufacturers," which points out the value of the motor drive as applied to this industry and the salient features of Westinghouse electrical equipment in this connection. Some very interesting facts in regard to the clothing industry are revealed in the 1914 Government census report, showing that in that year only two-thirds of the power employed was electric power. The present is a particularly important time in this industry for making the economies accomplished by electric drive, both on account of the very large output required for war purposes and domestic purposes, and the comparatively small amount of labor available. In this publication a complete line of electrical apparatus for garment manufacturers, including motors for power tables, motors for individual sewing machines, electric pressing irons, lamps, fans and ventilating fans, is illustrated and described in detail. A number of illustrations showing typical installations of Westinghouse motors in garment factories are also contained in this booklet.

A. D. Baker Electric Company, Clinton, Iowa, has sold its entire stock and business to George A. Walter of Fulton, Ill., who will continue it hereafter as his own business. Mr. Walter has for many years been identified with this field and is thoroughly experienced in the electrical business.

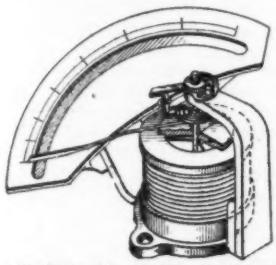
Edison Storage Battery Supply Company has removed its New Orleans office from 201 Baronne street to larger and more commodious quarters in the Maison Blanche building. This move is indicative of the increasing demand for Edison storage batteries throughout the South, where the economies of the electric commercial vehicle, the storage battery industrial truck, the storage battery tractor and locomotive are becoming more and more recognized for practicability and efficiency in many widely varying classes of business. Mr. D. B. Mugan is district sales manager.

Holophane Glass Company, 340 Madison avenue, New York City, recently published a 36-page book entitled "The New Era in Street Lighting." This book describes and illustrates the results of recent scientific research and shows how these results have been practically applied to street lighting. The application of these principles is called "Scientific Street Lighting"—a system which meets the requirements of good service to a maximum extent at a minimum cost. This book should prove of special value at the present time, because it explains what is meant by conservation in street lighting and shows how to effect marked economies, such as being able to reduce the energy consumption by one-half and obtain illumination equally as effective as was formerly possible. Considerable space in the book is devoted to a discussion of the requirements of adequate street lighting and how these may be attained, it being shown that uniformity of illumination is the most effective and therefore the ideal to work toward. How uniformity can be approximated is set forth in the review of the development of the Holophane prismatic refractor, the design, construction and characteristics of which are described at length. Many valuable suggestions and data are given on location, spacing and mounting of street lamps and how these affect the distribution and cost of illumination obtained. The book has over 40 fine illustrations of street-lighting views, lighting units, types of refractors, distribution curves, etc. This is the first book ever published giving a complete resume of the recent progress in street-lighting practice and its publishers have spared no effort and expense to make it most comprehensive. A limited quantity of these books are available for distribution to engineers and city officials and may be obtained by addressing the Holophane Company, in their official capacity.

Recent Patents

Selected and Summarized by Albert Scheible, Patent Attorney, 79 West Monroe Street, Chicago, Illinois

Measuring Instrument (1,267,914).—To make an electrical measuring instrument with a long scale and substantially dead beat, Robert Shand, of Lynn, Mass., uses two magnetic members within a coil, one being stationary and both being helical in shape so that the repulsion of one by the other will produce a considerable movement. These magnetic members are



No. 1,267,914.—Measuring Instrument.

inclosed in an air chamber so as to dampen the movement. (Patent assigned to the General Electric Co.)

Single-Phase Motor (1,269,152).—A stator winding with power coils and auxiliary coils in peculiar angular relations to each other is described in this patent to Julius Becker, of Racine, Wis.

Revolving Ventilating Fan (1,267,752).—In the fan of this patent, assigned by Herbert I. Finch, of St. Louis, to the Emerson Electric Mfg. Co., a worm connected to one of the motors rotates the mechanism about the pedestal, so that the rate of rotation is always in direct proportion to the speed of the fans. The fans and their motors can also be adjusted at varying angles with the pedestal, so as to vary the effective air distribution.

Electric Resistance Device (1,267,973).—When certain metals, such as aluminum, are immersed in a suitable electrolyte and subjected to an electric current, an insulating film of a metallic compound is formed on them. This film readily conducts heat, hence Lewis W. Chubb utilizes its properties in making resistance elements of aluminum cooled by a film-forming electrolyte. (Patent assigned to the Westinghouse Electric & Mfg. Co.)

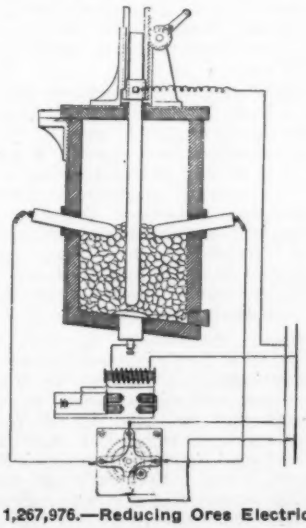
Protective Device (1,269,534).—A spark gap between the ground and the line which is to be protected is in a vessel containing a partial vacuum and also containing radioactive material. This material affords a continuous supply of ions within the vicinity of the spark gap, thereby eliminating the time lag between the application of the break-down voltage across the gap and the discharge of the gap. (Patent assigned by George Francis Gray, of Schenectady, N. Y., to the General Electric Co.)

A series of brief comments on some of the recently issued electrical patents which appear to be of particular interest to our readers, the number after each heading being that of the United States patent to which the summary relates. Any correspondence regarding such patent matters should be sent direct to Mr. Scheible at the above address.

Controlling Electric Current (1,268,348).—To prevent an overheating of electric flat irons or the like, Varian M. Harris, of Chicago, uses a controller which only supplies the current intermittently after the heated device has reached a given temperature.

Electric Fish Stop (1,269,380).—Electrodes are arranged at intervals along the stream and are connected to means for furnishing currents of progressively increasing strength. The electrodes used are hollow, so as to float and cause the current to pass from the surface of the water to the bottom of the latter. (Patented by Henry T. Burkey, of Tulsa, Okla.)

Reducing Ores Electrically (1,267,976).—In addition to the main electrodes used for passing current in an electric furnace vertically through the charge, Bayard G. Cobb, of Dawson City, Yukon, uses a pair of supple-



No. 1,267,976.—Reducing Ores Electrically.

mentary electrodes in contact with the charge and frequently reverses the polarity of these supplementary electrodes.

Indurated Leather (1,269,292.—Leather impregnated with solidified synthetic resin (or so-called condensite) is claimed as a new product by James McIntosh, of Norristown, Pa., in this patent, assigned by him to the Diamond State Fibre Co.

Metal Coating (1,268,987).—To beautify and protect steel surfaces, Earle W. McMullen, of Kenosha, Wis., deposits a coating of zinc electrically upon the surface of the steel and afterwards coats the deposit with a cellulose lacquer. The patent was assigned to the Simmons Company, also of Kenosha.

Electric Soldering Iron (1,268,877).—Instead of requiring the workman

No. 1,268,877. — Solder-Feeding Electric Soldering Iron.

to use one of his hands for holding the solder, Harry A. Orme, of Washington, D. C., feeds the solder through the axis of the tool and controls the feed by a trigger within reach of the hand that holds the tool.

Battery Depolarizer (1,269,173).—To make this depolarizer, Harry F. French and Raymond C. Benner, both of Fremont, Ohio, reduce copper oxide with an excess of sulphur and then reoxidize the reduced mass in presence of the excess sulphur. Patent assigned to National Carbon Co.

Hand Signaling Device (1,267,436).—L. W. Martin of New York City mounts on the back of a glove-like lamp a casing containing dry cells and lamps of different color, connected to contact points placed in the palm of the hand so that the lamps can be lighted conveniently by pressing with the fingers.

Solenoid Switch (1,269,564).—Three magnetic circuits are employed in the switch of the patent assigned by Clark T. Henderson and William C. Stevens to the Cutler-Hammer Mfg. Co., of Milwaukee. One tends to move the plunger, a second holds the plunger against movement, and the third increases the moving force of the first after the latter has overcome the holding force.

Stimulating Plant Growth (1,268,949).—"Method and apparatus for agricultural engineering" is the title given to this patent by the well known wireless expert, Reginald A. Fessenden, of Brookline, Mass. He subjects the plants whose growth is to be influenced to an electrical discharge of a definite and relatively low frequency and periodically varies the intensity of the discharge.

Men in Service

Major F. G. Bolles Ordered Overseas—Byllesby Interests Well Represented—G. B. Randall Receives Promotion

RAY POWERS, who prior to his enlistment in Government service was connected with the Northern States Power Company at Young America, Minn., is at present stationed at Ft. Leavenworth, Kans., in the Signal Corps.

CAPTAIN GEORGE H. CANFIELD, formerly of the land department of the Pacific Gas & Electric Company, was recently appointed major of the Second Battalion, 316th Engineers, stationed at Camp Lewis.

R. L. BARD, formerly connected with the Street Department of the Commonwealth Edison Company, Chicago, was recently awarded a commission as second lieutenant in the Marine Corps at the Marine Officers' Training Camp, held at Quantico, Virginia.

ROSE POLYTECHNIC INSTITUTE in the June number of Rose Technic publishes its complete roll of honor, listing 210 names and giving the rank, military organization and address. Of this number 13 are students, 142 graduates, 39 non-graduates and 16 in civilian service.

SAMUEL COHEN, of the engineering department of the Rochester Railway & Light Company, Rochester, N. Y., is now with the Ordnance Training School at the Carnegie Institute of Technology, where he is taking an eight weeks' course preparatory to securing a commission in the Ordnance Department.

ROBBINS & MYERS COMPANY, manufacturer of electric motors, generators and fans, Springfield, Ohio, has added the following names to its roll of honor: Carl Moon, Paul Clark, Bernard Warfel, Robert Gray, Walter Hartley, A. F. Brucker, Mike Piteo, E. C. Edwards, Atwood Hursch, Carl E. Lacy, Willard Holt, Frank Paul, Charles Beau, Roy L. Culp, Floyd Miller, R. Elmer Cleveland and Earl B. Miller.

PACIFIC GAS & ELECTRIC COMPANY, San Francisco, Cal., now carries on its roll of honor the names of 482 employees who have entered the service of the United States. The following employees have enlisted but have not as yet been called into active service: Howard C. McDonald, William T. Martin, San Francisco office; Ralph Short, Santa Rosa, and Alec R. Walker, Marysville.

H. M. BYLLESBY & COMPANY in the revised edition of the Byllesby National Service Record, as of July 1, shows that 82 officers and employees of the company and its subsidiaries are now engaged in overseas service for the Government. Of the 696 men of the organization who are now serving the allied cause in either the army or navy there are: one brigadier general, one lieutenant-colonel, three majors, two captains, 25 first lieutenants, 16 second lieutenants, 51 sergeants, 25 corporals, 488 privates in the army, and two ensigns, one boatswain's mate, six yeomen, 63 seamen in the navy, and 11 privates in the marines.

ROLL OF HONOR.

The electrical industry, perhaps to a greater extent than any other industry, has answered the call of the Nation for Men. As this is a war of engineers, naturally the technically trained men in the electrical industry have been in great demand and they have responded with splendid patriotism. Many of the large utility and industrial corporations have assigned men for Government service aside from those who have voluntarily entered or been called for service.

THE ELECTRICAL REVIEW *will welcome news concerning men who have entered the service or who are engaged in any patriotic duties.*

E. J. MCGUIRE, of the auditing department of H. M. Byllesby & Company, Chicago, has joined the navy and is stationed at Great Lakes, Ill.

S. B. SHAW, an engineer of the valuation department of the Pacific Gas & Electric Company, San Francisco, Cal., has enlisted in the navy and was given the rank of first-class yeoman. He has been assigned to duty at the Union Iron Works in San Francisco.

LIEUTENANT WALTER D. SULTAN, formerly of the Pacific Gas & Electric Company, San Francisco, has been assigned to the engineering section of the Aviation Corps, after receiving special training at schools at Columbus, Ohio, and the Massachusetts Institute of Technology.

G. B. RANDALL, formerly in the employ of the Union Electric Light & Power Company, St. Louis, Mo., in the county division, and later connected with the Curtis Manufacturing Company, was recently promoted to the rank of lieutenant-colonel in the Engineers Corps. Colonel Randall attended the officers' training camp at Fort Leavenworth and is at present stationed with the Thirty-seventh United States Engineers at Fort Myer, Virginia.

PACIFIC TELEPHONE & TELEGRAPH COMPANY, in line with many other utility companies has suffered the loss of many men for military service. It is reported that on June 1, 218 former employees were enlisted in the United States Signal Reserve Corps and Naval Reserve Force. Voluntary enlistments in other branches of the army numbered 255 and 115 others were serving after selection in the draft. Ninety-six men were engaged in other naval service and 18 were in car service not directly connected with the above. These, with 15 employees of subsidiary companies, made a total of 717 men in the service on that date.

L. J. LEMEN, manager of the Massillon Electric & Gas Company, Massillon, Ohio, has resigned to enter the army.

R. H. MACWHORTER, former manager of the Pacific Telephone & Telegraph Company at Raymond and South Bend, Wash., is now located at Camp Custer, Mich. He has been appointed captain of Radio Company No. 310, Field Squadron Battalion.

ARTHUR M. NEWHOUSE, formerly in the French Warfare Section, Ordnance Department, and later appointed progress engineer for the U. S. Shipping Board at Washington, D. C., has recently entered the Bureau of Industrial Housing and Transportation in the Estimating Department, and will handle electrical estimates and specifications.

HERSCHEL B. KING, of the Elmira Water, Light & Railroad Company, Elmira, N. Y., has been cited by the colonel of a French regiment for bravery and coolness under fire, and has been awarded the Croix de Guerre, the most coveted of all war decorations. Mr. King enlisted in the 15th Field Artillery last year and went to France several months ago, where he was attached to a signal corps.

FRELING FOSTER, a member of the staff of the Society for Electrical Development for the past year, is now engaged in research and editorial work in the accounting division of the Bureau of Supplies and Accounts, Navy Department, and is stationed at Washington, D. C.

H. J. TAIT, foreign manager for the Ivanhoe-Regent Works of General Electric Company, has been called to service in the National Army and is at present stationed at Camp Gordon, Atlanta, Ga. Under the old firm name of the Holophane Works of the General Electric Company he acted as advertising manager and special representative, and during the past four years has built up a large volume of foreign business in Ivanhoe metal reflectors and Regent illuminating glassware.

FRANK G. BOLLES, who some time ago was appointed a major in the Ordnance Department of the United States Army, has been relieved from duty as army inspector of ordnance in the office of the Mosler Safe Company at Hamilton, Ohio, and has received orders which will take him overseas. Major Bolles was formerly connected with the International Trade Press, Inc., and more recently vice-president of the Russian-American Trading Corporation of New York. He was for many years identified with large electrical and manufacturing interests, among which are the Westinghouse Companies, Allis-Chalmers Manufacturing Company, Bullock Electric Company and others. Prior to his enlistment in Government service he was engaged in extensive research work abroad for the Department of Commerce.

Personal

W. C. Lounsbury Becomes General Manager of Superior Water, Light & Power—W. B. Pierce Promoted—Changes

R. ALLAN STEPHENS, an attorney of Danville, Ill., has been named secretary of the Illinois Public Utilities Commission.

JAMES C. LEGG, Centreville, Md., has been appointed a member of the Public Service Board by Governor Harrington, succeeding E. Clay Timanus.

ROBERT A. BACHMAN, connected with Thomas A. Edison, Inc., Orange, N. J., for the past 17 years as vice-president, and general manager of the Edison Storage Battery Company, has resigned.

ROBERT C. HUMMEL has resigned his position as manager of the Pacific Telephone & Telegraph Company at Okanogan, Wash., to become connected with the Okanogan Valley Power Company at Nighthawk, Wash.

CHARLES WALKER, assistant engineer at Station 3 of the Rochester Railway & Light Company, Rochester, N. Y., has resigned to accept a position as superintendent of the Hornell Electric Company, Hornell, N. Y.

H. E. STOCKER has resigned his position as production manager of the Fort Wayne works of the General Electric Company to become general manager of the International Clay Machinery Company, Dayton, Ohio.

C. O'B. MURPHY, assistant general manager of the American Public Utilities Company, Grand Rapids, Mich., has been transferred to the position of vice-president and general manager of the Merchants' Public Utilities Company and the Merchants' Heat & Light Company, Indianapolis, Ind., both of which are controlled by the American Public Utilities Company.

NEWCOMB CARLTON, president of the Western Union Telegraph Company, 165 Broadway, New York, has been appointed a member of the local district committee on Capital Issues by the Capital Issues Committee, Washington. Lewis Lillie, the United Gas Improvement Company; Louis A. Ferguson, the Commonwealth Edison Company; Chicago, and B. E. Sunny, Chicago Telephone Company, have also been appointed members for their respective districts.

WILLIAM C. LOUNSBURY has recently been elected general manager of the Superior (Wis.) Water, Light & Power Company. He has been general superintendent for a number of years and is well known among the fraternity of electric, gas and water men. He is a member of a number of technical societies and is at present vice-president of the Wisconsin Electrical Association. Mr. Lounsbury was born 38 years ago in Brooklyn, N. Y., and is a graduate of the Massachusetts Institute of Technology. The Superior company operates the water, gas and electric utilities of the city, and Mr. Lounsbury's promotion is the result of 12 years' work with the company.

I. D. LANDIS was recently appointed sales manager of the John D. Godfrey Company, Elkhart, Ind., manufacturer of coal-handling devices.

THOMAS M. MCCARTER, Newark, N. J., president of the Public Service Corporation, has resigned as a member of the New Jersey Bridge & Tunnel Commission.

C. P. HARRISON, who has been superintendent of the Southern Illinois Railway & Power Company since 1913, has resigned and will be succeeded by D. A. Roberts, of Marion, Ill.

J. F. BASE, formerly an engineer with Stone & Webster, has accepted a position as drainage and sanitary engineer on camp sanitation work for the U. S. Public Health Service.

J. F. OWENS, vice president and general manager of the Oklahoma Gas & Electric Company, has been appointed chairman of the New Industries Committee of the Chamber of Commerce of Oklahoma City, Okla.

LINCOLN BEERBOWER, manager of the Enid division of the Oklahoma Gas & Electric Company, Enid, Okla., has been appointed chairman of the Industrial Committee of the Chamber of Commerce for the ensuing year.

E. G. NILES, president of the New Hampshire Public Service Commission, and president of the National Association of Railway Commissioners, has been appointed manager of the short line section of the Railroad Administration.

IRWIN H. BENNY, formerly superintendent of the A. H. Fox Gun Company, Philadelphia, Pa., has joined the staff of the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.

B. H. ELLIOTT, formerly superintendent of lines of the Birmingham (Ala.) Railway, Light & Power Company, has been promoted to the position of superintendent of power houses and substations of the company.

C. W. REES, for some time superintendent for the Tri-State Telephone & Telegraph Company at Grand Forks, N. D., has resigned to become manager of the Sioux Falls (S. D.) branch of the Bridgeman-Russell Company.

W. B. PIERCE, who for the past eight months has been handling the Government sales work of the Edison Electric Appliance Company at Washington, has been appointed Eastern district sales manager for the company with headquarters at 147 Waverly place, New York. Mr. Pierce was for seven years connected with the Western Electric Company in Chicago, having opened up its house goods and electrical device department. He later joined the selling force of the Hughes Electric Company, and for the past three years has handled the sales work in New England, New York and Pennsylvania territory.

RAYMOND D. SHERMAN, electrical superintendent of the Schenectady Power Company, Schaghticoke, N. Y., has tendered his resignation to accept the position of superintendent of the Readsboro (Vt.) plant of the New England Power Company.

H. J. MEYER, of the Charles L. Pillsbury Company, consulting engineers, Minneapolis, has been appointed by the U. S. Fuel Administration as engineer of Minnesota Fuel Administration to act in fuel conservation matters. One of the aims is to utilize all possible power of hydroelectric plants in that state.

Obituary.

HERMAN R. BOISSIER, head of the Boissier Electric Company, 215 West Nineteenth street, New York City, died on July 12, at his home in Great Neck, L. I., aged 72 years.

CHARLES A. GOODNOW, vice-president of the Chicago, Milwaukee & St. Paul Railway Company, passed away July 26 after a brief illness at Seattle, Wash. Mr. Goodnow was born at Baldwinsville, Mass., and as a boy entered the services of the Vermont & Massachusetts Railroad and was consecutively with the Fitchburg, Troy & Greenfield, Hoosac Tunnel & New York, West Shore & Buffalo Railroads, as train dispatcher and train master. In December, 1884, he entered the employ of the Chicago, Milwaukee & St. Paul Company as superintendent of construction, later becoming division superintendent, assistant general superintendent, and general superintendent. He left the St. Paul line in 1902 to become general manager of the Chicago, Rock Island & Pacific Railroad and upon the reorganization of that company in November, 1903, became general manager of the Chicago & Alton.

In 1908 he returned to the St. Paul line as assistant to the president and on July 1, 1917, was elected a vice-president of the company. During the term of service with the St. Paul, Mr. Goodnow had charge of the great electrification work of the company in Montana, where 440 miles of the line in successful operation by electric power over the Rocky and Bitter Root Mountains bear testimony to his constant and efficient planning and supervision during the construction period. The section of the line crossing the Cascade Mountains in Washington is now being electrically equipped and it was the promotion of this work that called him to Seattle about three weeks ago. He also had charge of the construction of the branch lines in Montana and of the Puget Sound & Willapa Harbor line in Washington; also of the extensive car ferry system of the company operating between Seattle and important industrial centers on Puget Sound. He leaves a wife and one daughter, Mrs. William Shields, of Glen Ridge, N. J.

Financial News

Foundation Laid for Big Utility Finance Body.

A foundation has been provided for the structure of a corporation to be owned by banking and public utility interests and created for the purpose of financing public utility companies with the assistance of the War Finance Corporation. Details of the venture will be worked out as soon as Secretary of the Treasury McAdoo returns from the West.

The new corporation will be dominated by banking firms which in the past have made a business of financing utility enterprises and by three of the large trust companies of New York. The amount of capital to be employed, the name and scope of operation of the corporation will be determined at a conference with Secretary McAdoo.

In the current calendar year utilities corporations of the country have notes and other obligations maturing to an amount estimated between $100,000,000 and $150,000,000. The War Finance Corporation has declined to make loans directly to these concerns, suggesting that if the utilities make arrangements for borrowing at the banks the finance corporation would then advance to the banks 75 per cent of the amount loaned to utilities. The banks, however, have felt unable to enter into such wholesale financing in view of Government and commercial demands.

With the proposed concern properly organized it will be possible to make loans to the utilities corporations and have these discounted by the War Finance Corporation to the extent of 75 per cent of their face value.

What the capital of the private corporation will be has not been announced. A round figure at $100,000,000 may be taken. Such a sum would enable the banking concern to lend at least $300,000,000 by means of rediscounts with the War Finance Corporation and still have a free capital of $25,000,000 remaining. If all the capital should be employed the concern would be able to lend $400,000,000, all based on the supposition that the War Finance Corporation will discount the loans offered to it.

Interborough Rapid Transit Note Order Adopted.

An order permitting the Interborough Rapid Transit Company to issue $39,416,000 face value of 7 per cent notes, dates as of July 1, 1918, and maturing July 21, 1921, convertible at maturity into 5 per cent bonds of the Interborough Company at 87½ per cent of the face value of said bonds, has been adopted by the Public Service Commission for the First District. The opinion in the case, prepared by Commissioner Charles Bulkley Hubbell, sets forth the reasons for the Commission's actions. Provision was made that the notes should be sold so as to net the Interborough Company not less than 95½ per cent of the face value thereof, besides interest accrued thereon. Bonds of the company are to be deposited as collateral security for the notes. It was therefore necessary for the Commission to approve an order permitting the company to issue $61,596,500 in 5 per cent bonds. That the amount of the bond issue is considerably larger than the amount of the note issue, is explained by the fact that, in keeping with the provisions of the statute creating the War Finance Corporation—which body it is expected will take a part of the notes—collateral must be deposited for loans which that corporation makes at 125 per cent of face value.

Edison Electric Notes.

The Edison Electric Illuminating Company has sold $3,000,000 four-year 7 per cent notes, due August 1, 1922, to Lee Higginson & Company, Old Colony Trust Company, F. S. Moseley & Company, Kidder, Peabody & Company, and Parkinson & Burr. The proceeds will pay for an increase in the capacity of the generating and distribution systems. The bankers are offering the notes on a 7.10 per cent basis.

Commonwealth Railway Bonds.

Plans have been made by the Commonwealth Railway & Light Company for the refunding and part payment of the company's $8,047,000 five-year 6 per cent convertible bonds that came due May 1, 1918. The War Finance Corporation has granted $2,400,000 on terms satisfactory to the corporation on condition that the holders of the bonds agree to an extension. Two plans have been presented. Holders of matured bonds are offered the option of accepting for each $1,000 bond either a new $1,000 five-year 7 per cent secured convertible gold bond and $25 in cash, representing 2½ per cent discount on the new bonds, or a new $700 five-year 7 per cent convertible gold bond and $17.50 in cash, representing discount at 2½ per cent on $700 new bonds, $300 in cash, representing payment of principal to which will be added interest at 7 per cent on $300 from May 1, 1918, to date of payment.

Public Utility Ownership.

The Electrical News of Toronto, of July 15, discussing the subject "Public Control with Private Operation," concludes with the following two paragraphs:

"Excellent as the theory of municipalities owning their own utilities may be, there is no doubt whatever that it has been a fatal policy for many of our cities and towns throughout Canada, who in their endeavor to avoid the evil of uncontrolled private ownership, fell into the trap of uncontrollable municipal ownership.

"There is evidence, however, that all over Canada, having now had experience with both evils, we are sitting back and taking a survey of the whole situation with a view to effecting a compromise that will include as many as possible of the good points and as few as possible of the bad points of the two systems."

Dividends.

Mobile Electric Company has declared a quarterly dividend of 1¾ per cent on preferred stock, payable August 15 to stock of record July 31.

American Utilities Company has declared a quarterly dividend of 1 per cent on preferred stock, payable August 10 to stock of record July 31.

Capitol Traction Company of Washington, D. C., has declared an extra dividend of one-half of one per cent.

Earnings.

TWIN CITY RAPID TRANSIT.

For the six months to June 30—Gross, $4,847,574, decrease $328,371; net, $1,332,082, decrease $435,791; surplus after charges and taxes, $394,002, decrease $497,859.

June gross, $808,432, decrease $44,764; net, $265,663, decrease $45,294; surplus, after charges and taxes, $110,050, decrease $55,309.

PHILADELPHIA COMPANY.

For June—	
Gross	$1,883,417
Net	671,296
From April 1—	
Gross	6,167,181
Net	2,741,004

UTAH SECURITIES.

For the 12 months ended June 30 subsidiary companies' gross was $6,923,598, increase $851,229; net, $3,707,078, increase $377,236. For June subsidiary companies' gross was $554,146, increase $26,069; net, $291,715, increase $27,577.

WEEKLY COMPARISONS OF CLOSING-BID PRICES OF SECURITIES OF LEADING ELECTRICAL COMPANIES.

Quotations furnished by F. M. Zeller & Co., Rookery Bldg., Chicago.

	Div. rate. Per cent.	Bid. July 23.	Bid. July 30.
Public Utilities—			
Adirondack Electric Power of Glens Falls, common	6	15	15
Adirondack Electric Power of Glens Falls, preferred	6	68	68
American Gas & Electric of New York, common	10+extra	80	81
American Gas & Electric of New York, preferred	6	39	37½
American Light & Traction of New York, common	..	184	186
American Light & Traction of New York, preferred	6	92	93
American Power & Light of New York, common	4	39½	40
American Power & Light of New York, preferred	6	66	66
American Public Utilities of Grand Rapids, common	..	..	..
American Public Utilities of Grand Rapids, preferred	6	..	..
American Telephone & Telegraph of New York	..	96	91¼
American Water Works & Elec. of New York, common	..	4½	4½
American Water Works & Elec. of New York, particip	7	11	12
American Water Works & Elec. of New York, first preferred	..	53	55
Appalachian Power, common	..	3	3
Appalachian Power, preferred	7	20	20
Cities Service of New York, common	+extra	204½	207
Cities Service of New York, preferred	6	74	74¼
Commonwealth Edison of Chicago	8	100	100
Comm. Power, Railway & Light of Jackson, common	..	20	21
Comm. Power, Railway & Light of Jackson, preferred	6	45	41½
Federal Light & Traction of New York, common	..	7½	7½
Federal Light & Traction of New York, preferred	..	35	35
Illinois Northern Utilities of Dixon	6	..	..
Middle West Utilities of Chicago, common	2+extra	10	10
Middle West Utilities of Chicago, preferred	6	37	37
Northern States Power of Chicago, common	..	40	42
Northern States Power of Chicago, preferred	ex.div.7	80	79
Pacific Gas & Electric of San Francisco, common	..	35¼	34½
Pacific Gas & Electric of San Francisco, preferred	6	80	80½
Public Service of Northern Illinois, Chicago, common	7	71½	72
Public Service of Northern Illinois, Chicago, preferred	6	82	82
Republic Railway & Light of Youngstown, common	4	18	20½
Republic Railway & Light of Youngstown, preferred	6	57	59
Standard Gas & Electric of Chicago, common	..	4	4
Standard Gas & Electric of Chicago, preferred	6	20	20
Tennessee Railway, Light & Power of Chattanooga, common	..	3	3
Tennessee Railway, Light & Power of Chattanooga, preferred	6	14	14
United Light & Railways of Grand Rapids, common	4	29½	30
United Light & Railways of Grand Rapids, preferred	6	61	62
Western Power of San Francisco, common	..	14	13½
Western Power of San Francisco, preferred	6	50	50½
Western Union Telegraph of New York	extra	84	80
Industrials—			
Electric Storage of Philadelphia, common	4	50	50
General Electric of Schenectady	8	144	145
Westinghouse Electric & Mfg. of Pittsburgh, common	7	42¼	42
Westinghouse Electric & Mfg. of Pittsburgh, preferred	7	60	58

*Last sale.